



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

**COMPETENCY BASED CURRICULUM**

# LIFT AND ESCALATOR MECHANIC

(Duration: Two Years)

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL- 5**



**SECTOR –POWER**



Directorate General of Training

# LIFT AND ESCALATOR MECHANIC

(Engineering Trade)

(Revised in 2019)

Version: 1.2

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL- 5**

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

EN-81, Sector-V, Salt Lake City,

Kolkata – 700 091

[www.cstaricalcutta.gov.in](http://www.cstaricalcutta.gov.in)

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

**FIRST YEAR:** In this year the trainee learns about safety and environment, use of fire extinguishers and artificial respiratory resuscitation. He gets the idea of trade tools & its standardization, identifies different types of conductors, cables & their skinning, joint making, soldering and crimping. He practices on allied trades like carpentry and fitting work. Basic electrical laws like Kirchhoff's law, ohm's law, laws of resistances and their application in different combinations of electrical circuit are practiced along with laws of magnetism. The trainee practices on testing and maintenance of batteries. The trainee works with different types of analog and digital measuring instruments. He also gets the basic idea of electronic components.

The trainee practices on basic civil/ drafting work. He uses lifting tools like hoist, pulley, chain block and carries out simple welding. He learns about panel wiring and fitment of various components. Basic function of Transformers and its testing is covered. The trainee practices on AC/DC machines, their starting, running, speed control, reversal of rotation and basic maintenance. He learns connection and operation of lift motor through VVVF drive, different parts of AC/DC drives, terminals of AC/DC drives. The trainee learns about power electronic devices viz., SCR, DIAC, TRIAC, UJT, FET, JFET, MOSFET etc., practices on D/A and A/C converters and controllers.

**SECOND YEAR:** In this year the trainee learns about safety practice to be adhered while working in elevators and escalators. He understands the working of Elevators, Escalators and Moving walkways. The trainee practices on installation/ fixing of all the component/ parts, control and safety circuits of Elevators. He understands installation process of lifts, types of elevator well, car bottom clearance, landing zone, top over travel, overhead clearance, observe running clearance. The trainee understands constructions and parts of escalators and moving walkways. He practices on various calculations like alighting areas, pit area etc. Practices on fixing of different mechanical parts, control and electrical equipment.

The trainee learns and practices on installation of various electrical and electronic control devices, safety devices, control panels, limit switches and power wiring, etc. He carries out various checks, testing/ tuning of components, examine safety devices of lifts, escalators

and moving walkways and ensures safe operation. The trainee practices on repairing/ replacement of electrical and electronic components, servicing of various mechanical parts, draining out and refilling of grease and oils, etc. He also gets familiarize with auto rescue device.

### 2.1 GENERAL

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

‘Lift and Escalator Mechanic’ trade under CTS is one of the popular courses delivered nationwide through network of ITIs. The course is of two-year 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 of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

#### **Trainee broadly needs to demonstrate that they are able to:**

- Read and interpret technical parameters/ documentation, plan and organize work processes, identify necessary materials and tools;
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge & employability skills while performing the job and repair & maintenance work.
- Check the component/ assembly as per drawing for functioning, identify and rectify errors in component/assembly.
- Document the technical parameter related to the task undertaken.

### 2.2 PROGRESSION PATHWAYS

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

## 2.3 COURSE STRUCTURE

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

S No.	Course Element	Notional Training Hours	
		1 <sup>st</sup> Year	2 <sup>nd</sup> Year
1	Professional Skill (Trade Practical)	100	1000
2	Professional Knowledge (Trade Theory)	280	360
3	Workshop Calculation & Science	80	80
4	Engineering Drawing	80	80
5	Employability Skills	160	80
	<b>Total</b>	1600	1600

## 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 DGT from time to time.

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

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

### 2.4.1 PASS REGULATION

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

## 2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

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

**Electrician General;** installs, maintains and repairs electrical machinery, equipment and fittings in factories, workshops power house, business and residential premises etc. Studies drawings and other specifications to determine electrical circuit, installation details etc. Positions and installs electrical motors, transformers, switchgears. Switch boards and other electrical equipment, fittings and lighting fixtures. Makes connections and solder terminals. Tests electrical installations and equipment and locates faults using Megger, test lamps etc. Repairs or replaces defective wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. May operate, attend and maintain electrical motors, pumps etc.

**Electrical Fitter;** fits and assembles electrical machinery and equipment such as motors, transformers, generators, switchgears, fans etc., Studies drawings and wiring diagrams of fittings, wiring and assemblies to be made. Collects prefabricated electrical and mechanical components according to drawing and wiring diagrams and checks them with gauges, megger etc. to ensure proper function and accuracy. Fits mechanical components, resistance, insulators, etc., as per specifications, doing supplementary tooling where necessary. Follows wiring diagrams, makes electrical connections and solders points as specified. Checks for continuity, resistance, circuit shorting, leakage, earthing, etc. at each stage of assembly using megger, ammeter, voltmeter and other appliances and ensures stipulated performance of both mechanical and electrical components fitted in assembly. Erects various equipment such as bus bars, panel boards, electrical posts, fuse boxes switch gears, meters, relays etc. using non-conductors, insulation hoisting equipment as necessary for receipt and distribution of electrical current to feeder lines. Installs motors, generators, transformer etc. as per drawings using lifting and hoisting equipment as necessary, does prescribed electrical wiring, and connects to supply line. Locates faults in case of breakdown and replaces blown out fuse, burnt coils, switches, conductors etc. as required. Checks, dismantles, repairs and overhauls electrical units periodically or as required according to scheduled procedure. May test coils. May specialize in repairs of particular equipment manufacturing, installation or power house work and be designated accordingly.

**Liftman;** Lift Operator operates electric lift to raise or lower cage, carrying passengers and goods from one floor to another in residential, office, hotel, hospital, commercial or industrial building according to bell or buzzer signals. Opens outer gate of lift entrance and inner gate of lift cage by turning handle or by electric switches to permit men and goods inside carrier cage, closes both gates manually or by electrical switches; presses electric push button of desired floor number as indicated in panel to move cage carrying men or material upward or downward as required. Stops lift at required floor by operating switches, opens double gates of lift for passengers and goods to move out and move in. Observes bell or buzzer sound to operate lift

to called floor to take men and material. Ensures that lift is not loaded over authorised capacity. Reports to superior malfunctioning of lift when detected. May operate automatic lifts which by push button action closes gates, travels and stops at required floor, automatically.

**Building and Related Electricians, other;** include all other electricians engaged in installation, maintenance and repairing of electrical wiring systems and related equipment not elsewhere classified.

**Reference NCO-2015:**

- a) 7411.0100– Electrician General
- b) 7412.0200–Electrical Fitter
- c) 8343.1800–Liftman
- d) 7411.9900–Building and Related Electricians, other

## 4. GENERAL INFORMATION

<b>Name of the Trade</b>	<b>LIFT AND ESCALATOR MECHANIC</b>
<b>Trade Code</b>	DGT/1074
<b>NCO - 2015</b>	7411.0100, 7412.0200, 8343.1800, 7411.9900
<b>NSQF Level</b>	Level-5
<b>Duration of Craftsmen Training</b>	Two Years (3200 Hours)
<b>Entry Qualification</b>	Passed 10 <sup>th</sup> class examination with Science and Mathematics or its equivalent.
<b>Minimum Age</b>	14 years as on first day of academic session.
<b>Eligibility for PwD</b>	LD, LC, DW, AA, DEAF, LV
<b>Unit Strength (No. Of Student)</b>	24 (There is no separate provision of supernumerary seats)
<b>Space Norms</b>	98.6 Sq. m
<b>Power Norms</b>	6 KW
<b>Instructors Qualification for</b>	
<b>1. Lift &amp; Escalator Mechanic Trade</b>	<p>B.Voc/Degree in Electrical/ Electrical and Electronics Engineering from AICTE/UGC recognized engineering college/ university with one year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Electrical/ Electrical and Electronics Engineering from AICTE/ recognized board of technical education or relevant advanced Diploma (Vocational) from DGT with two years experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/NAC passed in the Trade of "Lift and Escalator Mechanic" with 3 years experience in the relevant field.</p> <p><b><u>Essential Qualification:</u></b> Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT.</p>

	<p><b>Note: - Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.</b></p>
<p><b>(i) Workshop Calculation &amp; Science</b></p>	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Engineering from AICTE/ recognized board of technical education or relevant advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any one of the engineering trades with three years' experience.</p> <p><b><u>Essential Qualification:</u></b> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;"><b>OR</b></p> <p>NCIC in RoDA or any of its variants under DGT</p>
<p><b>(ii) Engineering Drawing</b></p>	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>03 years Diploma in Engineering from AICTE/ recognized board of technical education or relevant advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/ NAC in any one of the Electrical groups (Gr-II) trades categorized under Engg. Drawing' / D'man Mechanical / D'man Civil' with three years' experience.</p> <p><b><u>Essential Qualification:</u></b> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;"><b>OR</b></p> <p>NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.</p>
<p><b>(iii) Employability Skill</b></p>	<p>MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills</p>

	<p>from DGT institutes. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)</p> <p style="text-align: center;"><b>OR</b></p> <p>Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills from DGT institutes.</p>					
<b>(iv) Minimum Age for Instructor</b>	21 Years					
<b>List of Tools &amp; Equipment</b>	As per Annexure-I					
<b>Distribution of training on Hourly basis: (Indicative only)</b>						
Year	Total Hrs. /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	Employability Skills
1 <sup>st</sup>	40 Hours	25 Hours	7 Hours	2 Hours	2 Hours	4 Hours
2 <sup>nd</sup>	40 Hours	25 Hours	9 Hours	2 Hours	2 Hours	2 Hours

## 5. LEARNING 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.*

### 5.1 LEARNING OUTCOMES (TRADE SPECIFIC)

#### FIRST YEAR:

1. Use carpentry tools and undertake basic carpentry work following safety precautions.
2. Undertake basic fitting operations and use various instruments/ gauges to check different parameters.
3. Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance.
4. Select and use AC/ DC measuring instruments, measure electrical parameters and verify characteristics of electrical/ magnetic circuits.
5. Carry out Installation, testing and maintenance of batteries.
6. Carry out wiring, assembling of electrical accessories and earthing of electrical equipment.
7. Assemble simple electronic circuits and test for functioning.
8. Undertake basic civil/ drafting work, draw plane figures used in lifts and escalator by applying drawing instruments with proper layout.
9. Use lifting tools/ hoist equipment and perform simple welding & brazing.
10. Carry out industrial wiring of control panels, assemble accessories and equipment as per BIS recommendations and IE rules.
11. Install, connect, start, run, reverse and stop AC/ DC machines including synchronous motors and carry out maintenance along with protective and controlling devices.
12. Assemble power electronic circuits and test for functioning including digital electronic components and circuits.
13. Perform speed control of AC and DC motors by using solid state devices.

#### SECOND YEAR:

14. Carry out safe operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors.
15. Carry out installation of elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings.
16. Carry out installation of escalators and moving walkways in industries, shopping malls, subway stations and airport.

17. Install various electrical and electronic control devices, safety devices, control panels, limit switches and power wiring, etc. for control drives of lifts and escalators.
18. Carry out preventive & breakdown maintenance of lifts, escalators and moving walkways with due care and safety.
19. Carry out various checks, testing, tuning of components, examine safety devices and ensure proper functioning of lifts, escalators and moving walkways.

## 6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
<b>FIRST YEAR</b>	
1. Use carpentry tools and undertake basic carpentry work following safety precautions.	Identify carpenter's hand tools.
	Perform marking, filing and hacksawing.
	Perform cutting and planning of wood.
	Use firmer chisel and prepare simple half lap joint.
	Prepare T-joint, straight joint and dovetail joint on wooden blocks.
2. Undertake basic fitting operations and use various instruments/ gauges to check different parameters.	Demonstrate use of snips, marking and cutting of straight and curved pieces in metal sheets.
	Perform bending the edges of given sheets metal.
	Demonstrate use of taps and dies, threading hexagonal and square
	Make joints in metal sheet.
	Prepare an open box from metal sheet as per drawing.
	Measure air pressure and oil pressure using suitable gauges.
3. Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance.	Identify trade hand tools.
	Identify given cables and measure conductor size using SWG /micrometer.
	Perform skinning, twisting and prepare terminations of cable ends.
	Demonstrate crimping thimbles and lugs.
	Make simple twist/ married/ Tee / western union joints.
	Make britannia straight/ britannia Tee/ rat tail joint.
	Perform soldering of joints / lugs.
	Test insulation resistance of the given cable.
4. Select and use AC/ DC measuring instruments, measure electrical parameters and verify characteristics of electrical/ magnetic circuits.	Verify ohm's Law for different resistor values and voltage sources.
	Verify Kirchhoff's Law for different voltage and current.
	Verify laws of series/ parallel circuits with voltage source in different combinations.
	Measure resistance using voltage drop method.
	Measure resistance using Wheatstone bridge.
	Measure current, voltage and PF and determine the characteristics of RL/ RC/ RLC in AC series circuits.
	Measure current, voltage and PF and determine the characteristics

	of RL/ RC/ RLC in AC parallel circuits.
	Measure power and energy in single phase circuits.
	Measure Voltage/ Current/ Power/ Frequency/ Energy/ Power Factor in three phase circuit.
	Measure electrical parameters using tong tester in three phase circuits.
	Find the phase sequence of three phase system and identify the wires using phase sequence meter.
5. Carry out Installation, testing and maintenance of batteries.	Identify different types of cells.
	Group the given cells for specified voltage and current.
	Carry out preparation for charging of batteries.
	Demonstrate charging of Lead acid battery and explain different methods.
	Check discharged and fully charged battery.
	Carry out filling of electrolyte in lead acid battery.
	Explain procedures of routine, care/ maintenance and testing of batteries.
6. Carry out wiring, assembling of electrical accessories and earthing of electrical equipment.	Identify given wiring accessories and explain their purpose.
	Wire up a test board and fix switches, holder, plugs etc.
	Prepare electrical circuit; one lamp/ two lamp/ three lamp with wall socket/ stair case wiring.
	Measure earth resistance by earth tester / megger
	Test earth leakage by ELCB and relay.
7. Assemble simple electronic circuits and test for functioning.	Identify given active and passive components.
	Determine the value of resistance by colour code and identify their types.
	Test given active/ passive electronic components.
	Determine V-I characteristics of semiconductor diode.
	Construct half wave/ full wave/ bridge rectifier.
	Check transistors for its functioning and identifying its type and terminals.
	Bias the transistor and determine its characteristics.
8. Undertake basic civil/ drafting work, draw plane	Construct plain geometrical figures.
	Draw three view in orthographic Projection of line, surfaces,

figures used in lifts and escalator by applying drawing instruments with proper layout.	solidobjects.
	Draw different types of shallow foundation - Spread Footing/ Grillage foundation.
	Draw different types of deep foundation - Pile foundation/ Raft foundation/ Well foundation/ Special foundation.
	Demonstrate use of spirit level/ water level and plum bob.
9. Use lifting tools/ hoist equipment and perform simple welding & brazing.	Demonstrate use of tape, dial gauge, scale, try square, etc.
	Demonstrate operation of chain block, hoist, pulleys, shackle, ceiling and derricks etc.
	Identify components used in arc welding.
	Setup welding machine and perform welding.
	Demonstrate different welding joints.
10. Carry out industrial wiring of control panels, assemble accessories and equipment as per BIS recommendations and IE rules.	Identify various components of a control panel.
	Identify various components of different relays/ contactors and explain specifications, fittings in the control panel.
	Identify transformers/ toroidal inductors, resistors and capacitors their specifications, marking and fitment in the panels.
	Perform connections of three phase transformer and control transformers (CT & PT).
	Perform earthing and screening of cabinets as per IE rules and ensure proper earth continuity.
	Demonstrate mounting and connections of various control elements.
	Test the control panel.
11. Install, connect, start, run, reverse and stop AC/ DC machines including synchronous motors and carry out maintenance along with protective and controlling devices.	Identify terminals, parts and connections of different types of DC machines.
	Measure field and armature resistance of DC machines.
	Demonstrate starting/ reversal the direction of rotation of DC motor.
	Perform speed control of DC motors - field /armature control method.
	Test the DC motors - swinburne's test/ brake test.
	Perform no load and load test and determine characteristics of DC generators.
	Perform OC and SC test to determine and efficiency of single

	phase transformer
	Determine voltage regulation of single phase transformer
	Connect, start and run an alternator and build up the voltage and measure voltage and frequency
	Identify parts and terminals of different types of single phase AC motors.
	Start, run and reverse the direction of rotation of single phase AC motors.
	Test different single phase AC motors.
	Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters
	Identify terminals and connections of Synchronous motor/ Permanent magnet synchronous motor.
	Perform speed control of synchronous motor.
12. Assemble power electronic circuits and test for functioning including digital electronic components and circuits.	Verify characteristics of SCR, DIAC, TRIAC, FET, etc.
	Demonstrate and identify triggering circuits.
	Troubleshoot defects in simple power supply circuit.
	Test, analyze defects and repair UPS.
	Install an Inverter with battery.
	Identify pins of various ICs used in power electronic circuits.
	Demonstrate functioning and checking of DA/ AD converters.
	Check various registers/ counters/ timers.
	Identify and demonstrate different front panel control of a CRO.
Measure Amplitude, Frequency and time period of typical electronic signals using CRO.	
13. Perform speed control of AC and DC motors by using solid state devices.	Identify different parts/ terminals of AC/ DC drive.
	Connect A/D and D/A converters with drive.
	Connect and operate lift motor through VVVF drives.
	Perform speed control of lift motor using drive.
	Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive.
	Connect and run stepper/ servo motor using electronic controller.
<b>SECOND YEAR</b>	
14. Carry out safe operation of different types of lifts, escalators, moving	Identify different types of elevators – Hydraulic/ Pneumatic/ Traction.
	Demonstrate use of Personnel safety equipment viz., hard hat,

walkways, belt conveyors and bucket conveyors.	Safety belt, cut resistance gloves, dust mask, ear plug, head lamp, etc.
	Demonstrate emergency safety devices used in elevators.
	Identify components of elevator.
	Demonstrate working of elevator/ moving walkways.
15. Carry out installation of elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings.	Perform fixing of template/ bracket/ guide rail.
	Demonstrate counter weight, buffer, car frame, emergency stop switch.
	Demonstrate over speed Governor, safety circuit, overhead clearance and car bottom clearance.
	Perform fixing of Guide rails/ reed switch/ magnet and observe running clearance.
	Perform fixing of ropes/ belt / limit switches.
	Perform fixing and checking of electromagnet brake/ cams/ pulleys.
	Demonstrate fixing of machine beam and beam support.
	Demonstration fixing of spur gear/ worm gear/ bearings.
	Perform fixing of car components/ car lighting/ fan.
	Fix and adjust compensation chain and governor tension weight.
	Install car gate and cage.
	Demonstrate installation of travelling cable.
	Check of list and report for commissioning.
	Carry out testing of wiring circuit/ motor.
	Perform installation of governor and pulley.
Calculate car area for different No. of passengers.	
Calculate elevator speed for different applications.	
Calculate capacity of elevator as per No. of passengers.	
16. Carry out installation of escalators and moving walkways in industries, shopping malls, subway stations and airport.	Identify different part of escalator/ moving walkways.
	Calculate boarding and alighting areas for different sizes and types of escalators.
	Calculate pit area and support requirements.
	Perform fixing of drive unit, drive chain and shaft.
	Perform fixing of different covers and panels.
	Perform fixing of barriers and caution plates.
17. Install various electrical	Identify different control systems used in elevators.

and electronic control devices, safety devices, control panels, limit switches and power wiring, etc. for control drives of lifts and escalators.	Demonstrate automatic levelling devices and explain function.
	Demonstrate automatic levelling with main motor at various speeds.
	Identify different alarming modes.
	Prepare list for checking performance during test and trials.
	Perform repair for common defects.
18. Carry out preventive & breakdown maintenance of lifts, escalators and moving walkways with due care and safety.	Check physical location of all components of Lift/ Escalators/ Moving walkways as per drawing.
	Carry out repairing / replacement of mechanical components.
	Carry out repairing / replacement of electrical/ electronic components.
	Carry out servicing of various mechanical and electrical parts of escalators and moving walkways
	Drain down old grease/ oils and refill oil dashpots /grease cups.
	Lubricate car gate/ cam bellows/ buffer/ rope/ guiderail.
19. Carry out various checks, testing, tuning of components, examine safety devices and ensure proper functioning of lifts, escalators and moving walkways.	Check lift's main supply, switches, fuses and contacts.
	Examine & adjust all moving contacts of the controller.
	Check motor connections/ brush position/ air gap/ bearing.
	Check brake shoe, magnetic coil, oil in magnet case, dash pot adjustment etc.
	Check shaft bearing, drum, drive sheave for excessive play & proper lubrication.
	Examine safety governor for proper operating condition and lubrication.
	Examine main & counter weights, guide rail for lubrication and efficient functioning of brackets and rail clips.
	Check car shoes, buffers and its lubricants.
	Examine safety devices, tripping rod for its setting.
	Check emergency opening of door and other emergency safety devices.
	Check levelling of car platform.
Examine top and bottom final shaft way limit switches and other limit switches for their proper operation.	
Renew contacts/ replace limit switches.	

	Examine safety plank switch under car platform.
	Examine door contacts and gate contacts, adjusting /renewing parts.
	Examine emergency cut out switches for door and gate contacts.
	Examine light / fan switches / fixture in the car for proper operation.
	Check proper functioning of relays, timers, signalling system, alarming system, indications, electrical interlocks etc.

<b>SYLLABUS FOR LIFT &amp; ESCALATOR MECHANIC TRADE</b>			
<b>FIRST YEAR</b>			
<b>Duration</b>	<b>Reference Learning Outcome</b>	<b>Professional Skills(Trade Practical) With Indicative Hours</b>	<b>Professional Knowledge (Trade Theory)</b>
Professional Skill 100 Hrs;  Professional Knowledge 28 Hrs	Use carpentry tools and undertake basic carpentry work following safety precautions.	<ol style="list-style-type: none"> <li>1. Visit various sections of the institutes and identify locations of different installations. (2 hrs.)</li> <li>2. Identify safety symbols and hazards. (1 hr.)</li> <li>3. Practice safe methods of fire fighting and use of fire extinguishers. (5 hrs.)</li> <li>4. Locate all the first aid boxes in the institute and practice elementary first aid. (5 hrs.)</li> <li>5. Practice to isolate electric supplies and rescue a person safely in contact with electricity. (7 hrs.)</li> <li>6. Practice artificial respiration. (5 hrs.)</li> </ol>	Basic safety introduction, Personal protection. Basic injury prevention Hazard identification and avoidance, safety signs for Danger, warning, caution and personal safety messages. Use of Fire extinguishers. Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard. Personal safety and factory safety. (07 hrs)
		<ol style="list-style-type: none"> <li>7. Demonstrate disposal procedure of waste materials. (3 hrs.)</li> <li>8. Practice use of personal protective equipments. (5 hrs.)</li> <li>9. Identify trade tools, machineries and different accessories pertaining to the trade. (6 hrs.)</li> <li>10. Practice on cleanliness and</li> </ol>	Identification of Trade-Hand tools-Specifications, Uses, their care and maintenance. Concept of Standards and advantages of BIS/ISI. Familiarization with signs and symbols of electrical accessories Soft skills and its importance. Introduction to 5S concept. (07 hrs)

		<p>procedure to maintain it. (4 hrs.)</p> <p>11. Basic workshop on 5S concept and practices. (7 hrs.)</p>	
		<p><b>Allied Trades:</b></p> <p>12. Demonstrate and identify carpenter's hand tools. (5 hrs.)</p> <p>13. Practice correct operations of allied trade tools. (5 hrs.)</p> <p>14. Practice on marking, filing and hacksawing. (6 hrs.)</p> <p>15. Practice on cutting and planning of wood. (6 hrs.)</p> <p>16. Drilling practice in hand drilling and power drilling machines. (5 hrs.)</p> <p>17. Practice in using firmer chisel and preparing simple half lap joint. (8 hrs.)</p> <p>18. Practice on preparing T-joint, straight joint and dovetail joint on wooden blocks. (7 hrs.)</p> <p>19. Practice sawing, planing, drilling and assembling for making a wooden board. (8 hrs.)</p>	<p>Introduction to wood structure and seasoning of wood.</p> <p>Carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing and holding tools, their importance, care and maintenance.</p> <p>Safety precautions to be observed.</p> <p>Description of files, hammers, chisels hacksaw frames and blades- their specification and grades.</p> <p>Study of various joints.</p> <p>Steel rule, try square and files. Marking tools description and use.</p> <p>Types of drills description and drilling machines, proper use, care and maintenance.</p> <p>(14 hrs)</p>
<p>Professional Skill 50Hrs;</p> <p>Professional Knowledge 14 Hrs</p>	<p>Undertake basic fitting operations and use various instruments/ gauges to check different parameters.</p>	<p>20. Practice in using snips, marking and cutting of straight and curved pieces in metal sheets. (4 hrs.)</p> <p>21. Practice making holes, securing by screw and riveting. (3 hrs.)</p> <p>22. Practice bending the edges of sheets metals. (5 hrs.)</p>	<p>Introduction of fitting trade.</p> <p>Marking tools; calipers Dividers, Surface plates, Angle plates, Scribers, punches, surface gauges</p> <p>Types, Uses, Care and maintenance.</p> <p>Use of different bench tools used by sheet metal worker.</p>

		<p>23. Workshop practice on drilling, chipping, internal and external threading of different sizes. (8 hrs.)</p> <p>24. Practice in using taps and dies, threading hexagonal and square nuts etc. cutting external threads on stud/ pipes and riveting practice. (8 hrs.)</p> <p>25. Practice in making different joints in sheet metal in soldering the joints. (7 hrs.)</p> <p>26. Prepare an open box from metal sheet. (8 hrs.)</p> <p>27. Demonstrate measurement of temperature. (3 hrs.)</p> <p>28. Measure air pressure and oil pressure using suitable gauges. (4 hrs.)</p>	<p>Description and types of taps and dies, Description of marking and cutting tools such as snubs shears punches and other tools like hammers, mallets, etc. used by sheet metal workers.</p> <p>Types of rivets and riveted joints. Use of thread gauge. Different types of threads. Materials, fluxes and process. Types of different soldering irons and their proper uses. Care and maintenance of tools.</p> <p>Introduction to thermometers, pressure gauges etc.(14hrs)</p>
<p>Professional Skill 75 Hrs;</p> <p>Professional Knowledge 21 Hrs</p>	<p>Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance.</p>	<p>29. Demonstrate and identify trade hand tools with specifications. (8 hrs.)</p> <p>30. Practice in using cutting pliers and screw drivers, etc. (7 hrs.)</p> <p>31. Identify various types of cables and measure conductor size using SWG and micrometer. (10 hrs.)</p> <p>32. Practice on skinning, twisting and prepare terminations of cable ends. (12 hrs.)</p> <p>33. Practice on crimping thimbles and lugs. (8 hrs.)</p> <p>34. Make simple twist,</p>	<p>Fundamentals of electricity, Electron theory, definitions, units &amp; effects of electric current.</p> <p>Definition and properties of conductors, insulators and semi-conductors.</p> <p>Wires/ cables &amp; their specifications. Types of wire joints &amp; uses.</p> <p>standard wire gauge Solders, flux and soldering technique.</p> <p>Types &amp; properties of resistors Specific Resistance.</p> <p>Introduction of National Electrical Code Cable</p>

		<p>married, Tee and western union joints. (10 hrs.)</p> <p>35. Make britannia straight, britannia Tee and rat tail joints. (10 hrs.)</p> <p>36. Practice in Soldering of joints / lugs. (5 hrs.)</p> <p>37. Test insulation resistance of different cables. (5 hrs.)</p>	<p>insulation &amp; voltage grades, permissible temperature rise. Precautions in using various types of cables/ ferrules. Trade hand tools; Uses, care and maintenance.(21hrs)</p>
<p>Professional Skill 150Hrs;</p> <p>Professional Knowledge 42 Hrs</p>	<p>Select and use AC/DC measuring instruments, measure electrical parameters and verify characteristics of electrical/ magnetic circuits.</p>	<p>38. Verify ohm's Law for different resistor values and voltage sources. (3 hrs.)</p> <p>39. Verify Kirchhoff's Law for different voltage and current. (3 hrs.)</p> <p>40. Verify laws of series and parallel circuits with voltage source in different combinations. (6 hrs.)</p> <p>41. Measure current and voltage and analyse the effects of shorts and opens in series and parallel circuits. (8 hrs.)</p> <p>42. Measure resistance using voltage drop method. (3 hrs.)</p> <p>43. Measure resistance using wheatstone bridge. (3 hrs.)</p> <p>44. Demonstrate the change in resistance of a metal with change in temperature. (3 hrs.)</p> <p>45. Verify the characteristics of series parallel combination of resistors. (8 hrs.)</p> <p>46. Measure current, voltage and PF and determine the</p>	<p><b>Ohm's Law -</b> Simple electrical circuits and problems.</p> <p><b>Resistors</b>-Laws of Resistance. Series, parallel and combination circuits.</p> <p><b>Kirchoff's</b>Laws and applications. Wheatstone bridge principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance.</p> <p><b>Alternating Current -</b> Comparison and Advantages D.C and A.C. Related terms frequency Instantaneous value, R.M.S. value Average value, Peak factor, form factor. Generation of sine wave, phase and phase difference. Inductive and Capacitive reactance Impedance (Z), power factor (p.f). Active and Reactive power, Simple problems on A.C. circuits, single phase and</p>

		<p>characteristics of RL, RC and RLC in AC series circuits. (10 hrs.)</p> <p>47. Measure the resonance frequency in AC series circuit and determine its effect on the circuit. (10 hrs.)</p> <p>48. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits. (8 hrs.)</p> <p>49. Measure power and energy in single phase circuits. (2 hr.)</p> <p>50. Measure Voltage, Current, Power, Frequency, Energy and Power Factor in three phase circuit. (5 hrs.)</p> <p>51. Measure electrical parameters using tong tester in three phase circuits. (5 hrs.)</p> <p>52. Find the phase sequence of three phase system and identify the wires using phase sequence meter. (8 hrs.)</p> <p>53. Practice on various analog and digital measuring Instruments viz., multimeter, megger, frequency meter, tachometer, clamp meter, etc. (15 hrs.)</p>	<p>three-phase system etc. Problems on A.C. circuits. Power consumption in series and parallel circuits. Concept of three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load.</p> <p><b>Measuring Instruments;</b> Classification, various types, viz., deflection type, recoding type and integrating type.</p> <p>Measurement of various electrical parameters using different analog and digital instruments. (28 hrs)</p>
		<p>54. Determine the poles and plot the field of a magnet bar. (2 hrs.)</p>	<p><b>Magnetism</b> - classification of magnets, methods of magnetizing magnetic</p>

		<p>55. Wind a solenoid and determine the magnetic effect of electric current. (5 hrs.)</p> <p>56. Measure induced emf due to change in magnetic field. (3 hrs.)</p> <p>57. Determine direction of induced emf and current. (3 hrs.)</p> <p>58. Practice on generation of mutually induced emf. (6 hrs.)</p> <p>59. Measure the resistance, impedance and determine inductance of choke coils in different combinations. (8 hrs.)</p> <p>60. Identify various types of capacitors. (3 hrs.)</p> <p>61. Demonstrate charging / discharging and testing of capacitors using DC voltage and lamp. (10 hrs.)</p> <p>62. Group the given capacitors to get the required capacity and voltage rating. (10 hrs.)</p>	<p>materials.</p> <p>Properties, care and maintenance.</p> <p>Paramagnetic, diamagnetic and ferromagnetic materials.</p> <p>Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left and right hand rules, Magnetic field of current carrying conductors, loop and solenoid. MMF, Flux density, reluctance.</p> <p>B.H. curve, Hysteresis, Eddy current.</p> <p>Principle of electro-magnetic Induction, Faraday's Law, Lenz's Law.</p> <p>Electrostatics: Capacitor-Different types, functions and uses. (14 hrs)</p>
<p>Professional Skill 75 Hrs;</p> <p>Professional Knowledge 21 Hrs</p>	<p>Carry out Installation, testing and maintenance of batteries.</p>	<p>63. Demonstrate and identify different types of cells. (8 hrs.)</p> <p>64. Undertake grouping of dry cells for specified voltage and current. (10 hrs.)</p> <p>65. Carry out preparation for charging of batteries. (10 hrs.)</p> <p>66. Practice on charging of Lead acid battery by</p>	<p>Chemical effect of electric current.</p> <p>Principle of electrolysis.</p> <p>Faraday's Law of electrolysis.</p> <p>Explanation of Anodes and Cathodes.</p> <p>Cells; Primary &amp; Secondary Lead acid cell; description, methods of charging, Precautions to be taken &amp; testing equipment.</p>

		<p>different methods. (10 hrs.)</p> <p>67. Check discharged and fully charged battery. (8 hrs.)</p> <p>68. Carry out filling of electrolyte in lead acid battery. (8 hrs.)</p> <p>69. Demonstrate installation of batteries. (8 hrs.)</p> <p>70. Practice on routine, care/ maintenance and testing of batteries. (15 hrs.)</p>	<p>Ni-cadmium &amp; Lithium cell, Different types of lead acid cells.</p> <p>Battery Charger, UPS, etc.</p> <p>Lead Acid cell, general defects and remedies.</p> <p>Nickel Alkali Cell-description, charging.</p> <p>Power and capacity of cells.</p> <p>Efficiency of cells.</p> <p>Rechargeable dry cell, description advantages and disadvantages.</p> <p>Grouping of cells for specified voltage and current.</p> <p>Sealed Maintenance free Batteries, Solar cell.</p> <p>Care and maintenance of cells. (21hrs)</p>
<p>Professional Skill 50Hrs;</p> <p>Professional Knowledge 14 Hrs</p>	<p>Carry out wiring, assembling of electrical accessories and earthing of electrical equipment.</p>	<p>71. Demonstrate wiring accessories viz., switches, fuses, lamps, MCBs, etc. (5 hrs.)</p> <p>72. Practice on installation and overhauling common electrical accessories. (10 hrs.)</p> <p>73. Practice on fixing of switches, holder, plugs etc. in wooden/PVC/ Metallic boards. (10 hrs.)</p> <p>74. Wire up a test board and check for it's functioning. (3 hrs.)</p> <p>75. Practice of various types of electrical circuit connections such as one lamp, two lamp, three</p>	<p>Common Electrical wiring accessories, their specifications in line with NEC.</p> <p>Explanation of switches, lamp holders, plugs and sockets.</p> <p>Alarm &amp; switches, Use &amp; specification of Fire alarm, Fuses, MCB, ELCB, and MCCB.</p> <p>Developments of domestic circuits.</p> <p><b>Earthing-</b> Principle and different methods of earthing i.e. Pipe and Plate earthing.</p> <p>Importance of Earthing.</p> <p>Improvement of earth resistance Earth Leakage</p>

		<p>lamp with wall socket, stair case wiring, tube light connection etc. (10 hrs.)</p> <p>76. Demonstrate earthing installations and measure earth resistance by earth tester / megger. (6 hrs.)</p> <p>77. Test earth leakage by ELCB and relay. (6 hrs.)</p>	<p>circuit breaker (ELCB). (14hrs)</p>
<p>Professional Skill 25 Hrs;</p> <p>Professional Knowledge 07 Hrs</p>	<p>Assemble simple electronic circuits and test for functioning.</p>	<p>78. Demonstrate and identify various active and passive components. (2 hrs.)</p> <p>79. Determine the value of resistance by colour code and identify types. (3 hrs.)</p> <p>80. Test active and passive electronic components. (3 hrs.)</p> <p>81. Determine V-I characteristics of semiconductor diode. (3 hrs.)</p> <p>82. Construct half wave, full wave and bridge rectifiers using semiconductor diode. (5 hrs.)</p> <p>83. Check transistors for their functioning by identifying its type and terminals. (4 hrs.)</p> <p>84. Bias the transistor and determine its characteristics. (3 hrs.)</p> <p>85. Use transistor as an electronic switch and series voltage regulator. (3 hrs.)</p>	<p><b>Basic electronics;</b></p> <p>Resistors – colour code, types and characteristics.</p> <p>Active and passive components.</p> <p>Atomic structure and semiconductor theory.</p> <p>P-type and N-type materials.</p> <p>P-N junction, classification, specifications, biasing and characteristics of diodes.</p> <p>Rectifier circuit - half wave, full wave, bridge rectifiers and filters.</p> <p>Principle of operation, types, characteristics and various configuration of transistor.</p> <p>Application of transistor as a switch, voltage regulator and amplifier. (06 hrs)</p>
<p>Professional Skill 50Hrs;</p>	<p>Undertake basic civil/ drafting work,</p>	<p>86. Practice drawing of Lines, lettering and</p>	<p>Definition and types of projections.</p>

<p>Professional Knowledge 14 Hrs</p>	<p>draw plane figures used in lifts and escalator by applying drawing instruments with proper layout.</p>	<p>dimensioning. (4 hrs.) 87. Construction of plain geometrical figures. (3 hrs.) 88. Construction of scales – Plain, comparative and diagonal. (1 hr.) 89. Practice drawing of Three view in orthographic Projection of line, surfaces, solid objects &amp; section of solids. (12 hrs.) Practice drawing of different types of foundation – (30 hrs.) Shallow: - 90. Spread Footing. 91. Grillage foundation. Deep: - 92. Pile foundation. 93. Raft foundation. 94. Well foundation. 95. Special foundation. 96. Demonstrate use of spirit level, water level and plum bob.</p>	<p>Methods of projection as per IS. Projection of points, lines, planes and solids. Concept of brick well, RCC well Foundation: Types, Purpose &amp; causes of failure of foundation. Drawing of footing foundation, excavation, shoring&amp; simple machine foundations.(14hrs)</p>
<p>Professional Skill 50Hrs; Professional Knowledge 14 Hrs</p>	<p>Use lifting tools/ hoist equipment and perform simple welding&amp; brazing.</p>	<p>97. Demonstrate use of tape, dial gauge, scale, try square, etc. (6 hrs.) 98. Demonstrate &amp; Practice of chain block, hoist, pulleys, shackle, ceiling and derricks etc. (10 hrs.) 99. Practice different types of knots. (4 hrs.) 100. Identify components used in arc welding. (5 hrs.) 101. Setup welding machine and practice arc welding.(5 hrs.) 102. Practice different welding</p>	<p>Measuring tools: tape, dial gauge, scale, try square. Lifting tools: chain block, hoist, pulley, shackle, ceiling, etc. Introduction to basic Fabrication work: fastening, temporary, semi-permanent and permanent. Nomenclature of derricks used in rigging. Process of welding and brazing Concept of different types of welding.</p>

		<p>joints. (10 hrs.)</p> <p>103. Perform metal joining by brazing. (10 hrs.)</p>	<p>Types of joints in welding.</p> <p>Types of electrode.</p> <p>Safety measures in welding. (12 hrs)</p>
<p>Professional Skill 100 Hrs;</p> <p>Professional Knowledge 28 Hrs</p>	<p>Carry out industrial wiring of control panels, assemble accessories and equipment as per BIS recommendations and IE rules.</p>	<p>104. Demonstrate various components of a control panel viz. DIN rails, plastic trunking, connector blocks and terminals etc. (06 hrs.)</p> <p>105. Demonstrate various components of different relays and contactors their specifications, fittings in the control panel and labelling. (05hrs.)</p> <p>106. Identify transformers/ toroidal inductors, resistors and capacitors their specifications, marking and fitment in the panels. (04 hrs.)</p> <p>107. Identify various fuses, fuse holders, specifications and their fittings. (3 hrs.)</p> <p>108. Identify various switches, push buttons, lamps used in control panels, their specifications and fitment in the panel. (4 hrs.)</p> <p>109. Demonstrate various thermostats and timers. (3 hrs.)</p> <p>110. Practice cable forming including template, binding, lacing, loop tie,</p>	<p>Indian Electricity rules pertaining to operation, construction and maintenance of Lifts and Escalators.</p> <p>Statutory provisions for getting license.</p> <p>Types of wires and cables used in lift.</p> <p>Wiring procedures and techniques, Types of switches for control &amp; power wiring.</p> <p>Types of Thermostats, timers and mercury switches.</p> <p>Specification &amp; ratings of MCB, MCCB, ELCB, ACB.</p> <p>Bus bars size and spacing</p> <p>Procedure for control panel erection.</p> <p>Single Phase Transformer; Types and Classification, specification and simple problems on e.m.f. equation, turns ratio and efficiency.</p> <p>Three Phase Transformer; Types &amp; Connections.</p> <p>Check of list for Do's and Don'ts for operation and maintenance. (28hrs)</p>

		<p>lock stitch, breakouts, twisted pair etc. (10 hrs.)</p> <p>111. Practice use of sleeves, bootlace ferrule, correct method of connections in terminal blocks and routing of cables. (10 hrs.)</p> <p>112. Pass cables through strain relief plate in an Electrical cabinet and secure the cables properly using cable tie/clamp. (10 hrs.)</p> <p>113. Practice fixing of bus bar and tapping connections from bus bar. (11 hrs.)</p> <p>114. Perform connections of three phase transformer and control transformers (CT &amp; PT). (12 hrs.)</p> <p>115. Practice earthing and screening of cabinets as per IE rules and ensure proper earth continuity. (5 hrs.)</p> <p>116. Practice mounting and connections of various control elements e.g. MCB, MCCB, relays, contactors, measuring instruments, sensors and timers etc. (12 hrs.)</p> <p>117. Test the control panel for its proper functioning. (5 hrs.)</p>	
Professional Skill 125Hrs;	Install, connect, start, run, reverse and stop AC/ DC	118. Identify terminals, parts and connections of different types of DC	DC machines; Principle of operation, Construction and types of DC motors and

<p>Professional Knowledge 35Hrs</p>	<p>machines including synchronous motors and carry out maintenance along with protective and controlling devices.</p>	<p>machines. (8 hrs.)</p> <p>119. Measure field and armature resistance of DC machines. (5 hrs.)</p> <p>120. Start, run and reverse the direction of rotation of DC motor. (6 hrs.)</p> <p>121. Perform speed control of DC motors - field and armature control method. (8 hrs.)</p> <p>122. Conduct different tests on DC motors viz., swinburne's test, brake test, etc. (7 hrs.)</p> <p>123. Perform no load and load test and determine characteristics of DC generators. (8 hrs.)</p> <p>124. Carry out maintenance on DC machines. (8 hrs.)</p>	<p>generators.</p> <p>Starting, Speed control methods, and efficiency.</p> <p>DC Generators; types, emf equation, armature reaction and commutation.</p> <p>Different characteristics of DC Generators. (14 hrs)</p>
		<p>125. Verify terminals, identify components and calculate transformation ratio of single phase transformers. (04 hrs.)</p> <p>126. Perform OC and SC test to determine and efficiency of single phase transformer. (03 hrs.)</p> <p>127. Determine voltage regulation of single phase transformer at different loads and power factors. (06 hrs.)</p> <p>128. Identify parts and terminals of an alternator. (03 hrs.)</p> <p>129. Connect, start and run an alternator and build up the voltage and measure</p>	<p>Working principle, construction and classification of transformer. Single phase and three phase transformers.</p> <p>Turn ratio, Voltage Regulation and efficiency.</p> <p>Auto Transformer and instrument transformers (CT &amp; PT).</p> <p>Principle of electromagnetic induction, Faraday's law, Lenz's law, Fleming's right /left hand rule.</p> <p>Single phase AC motors; Working principle, construction, Characteristics, testing, Starting methods and applications.</p> <p>Three phase induction</p>

		<p>voltage and frequency. (06 hrs.)</p> <p>130. Identify parts and terminals of different types of single phase AC motors. (04 hrs.)</p> <p>131. Start, run and reverse the direction of rotation of single phase AC motors. (03 hrs.)</p> <p>132. Practice on speed control of single phase AC motors. (8 hrs.)</p> <p>133. Test different single phase AC motors. (04 hrs.)</p> <p>134. Connect and test three phase induction motor. (04 hrs.)</p> <p>135. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters. (06 hrs.)</p> <p>136. Connect and test different control elements as per drawing. (06 hrs.)</p> <p>137. Identify terminals and connections of synchronous motor. (03 hrs.)</p> <p>138. Identify terminals and connections of Permanent magnet synchronous motor. (04 hrs.)</p> <p>139. Perform speed control of synchronous motor. (8 hrs.)</p> <p>140. Carry out maintenance on AC machines. (6 hrs.)</p>	<p>motors; Characteristics &amp; testing three phase induction motors, Starting methods and applications of poly phase induction motor.</p> <p>Common Motor control circuit elements; Start/ stop push buttons, indicators, contactors, etc.</p> <p>Simple drawings for starting and control circuit.</p> <p>Construction and working principle of synchronous motor.</p> <p>Construction and working principle of Permanent magnet synchronous motorSize/ rating of motor applicable for lift and escalator.</p> <p>(21 hrs)</p>
Professional	Assemble	141. Demonstrate simple	Types of electronic power

<p>Skill 75 Hrs; Professional Knowledge 21 Hrs</p>	<p>power electronic circuits and test for functioning including digital electronic components and circuits.</p>	<p>power control circuit by SCR, and DIAC/TRIAC. (4 hrs.)</p> <p>142. Demonstrate simple power control circuits using UJT, FET, JFET, MOSFET, IGBT. (5 hrs.)</p> <p>143. Verify characteristics of SCR, DIAC, TRIAC, FET, etc. (8 hrs.)</p> <p>144. Demonstrate and identify triggering circuits. (4 hrs.)</p> <p>145. Construct simple circuits containing UJT for triggering. (6 hrs.)</p> <p>146. Troubleshoot defects in simple power supply circuit. (6 hrs.)</p> <p>147. Test, analyze defects and repair UPS. (8 hrs.)</p> <p>148. Maintain, service and troubleshoot battery charger and inverter. (8 hrs.)</p> <p>149. Install an Inverter with battery. (2 hrs.)</p> <p>150. Identify pins of various ICs used in power electronic circuits. (3 hrs.)</p> <p>151. Demonstrate functioning and checking of DA/ AD converters. (4 hrs.)</p> <p>152. Check various registers, counters and timers. (3 hrs.)</p> <p>180. Identify the different front panel control of a</p>	<p>devices.</p> <p>Working principle of SCR, DIAC &amp; TRIAC, GTO, UJT, FET, JFET, MOSFET, IGBT.</p> <p>Biasing FET as amplifier and switch.</p> <p>UPS, Inverter and Battery charger.</p> <p>Analog to Digital converter Digital to analog converter Various types of ICs, Buffer Applications of power electronic devices.</p> <p>Introduction to CRO Types of oscillators and multi-vibrators.</p> <p>Basic calculation in oscillators.</p> <p>Introduction to Digital electronics; Logic gates and ICs.</p> <p>Combinational circuits and its classification.</p> <p>Number system, Registers, Counters and Timers.</p> <p>Digital memory types; ROM, RAM, EPROM.</p> <p>(21hrs)</p>
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		<p>CRO. (6 hrs.)</p> <p>181. Practice measuring of the Amplitude, Frequency and time period of typical electronic signals using CRO. (8 hrs.)</p>	
<p>Professional Skill 75 Hrs;</p> <p>Professional Knowledge 21 Hrs</p>	<p>Perform speed control of AC and DC motors by using solid state devices.</p>	<p>182. Identify different parts of AC/ DC drive. (6 hrs.)</p> <p>183. Identify terminals of AC/ DC drive. (9 hrs.)</p> <p>184. Connect A/D and D/A converters with drive. (15 hrs.)</p> <p>185. Connect and operate lift motor through VVVF drives. (10 hrs.)</p> <p>186. Perform speed control of lift motor using drive. (12 hrs.)</p> <p>187. Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive. (15 hrs.)</p> <p>188. Connect and run stepper/ servo motor using electronic controller. (8 hrs.)</p>	<p>Types of AC/DC drives</p> <p>Functions and block diagram</p> <p>Terminal connections; control and power circuit.</p> <p>Applications of AC/DC drive, Basic parameter setting in variable voltage variable frequency (VVVF) drive.</p> <p>Size and selection of drives used in lifts and escalators.</p> <p>Study of Specific control logic for lift motor operation.</p> <p>Parameter settings of drives for lift motor operation.</p> <p>Interfacing of A/D and D/A converters with drive.</p> <p>Speed control of motor by thyristor.</p> <p>Concept of stepper/ servo motor. (21hrs)</p>
<p><b>Project work / Industrial visit</b></p> <p><b>Broad Area:</b></p> <ul style="list-style-type: none"> <li>a) Welding and brazing</li> <li>b) Drawing plan</li> <li>c) Panel wiring with motor control</li> <li>d) Power electronic circuits and digital electronic components</li> <li>e) AC/DC drives</li> </ul>			

## SYLLABUS FOR LIFT & ESCALATOR MECHANIC TRADE

### SECOND YEAR

Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 100Hrs;  Professional Knowledge 36 Hrs	Carry out safe operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors.	<p>189. Demonstrate different types of elevators viz., Hydraulic, Pneumatic, Traction, etc. (20 hrs.)</p> <p>190. Demonstrate different types of conveying equipment viz., Escalators, Belt conveyor, Bucket conveyor, etc. (20 hrs.)</p> <p>191. Practice use of Personnel safety equipment viz., hard hat, Safety belt, cut resistance gloves, dust mask, ear plug, head lamp, etc. (8 hrs.)</p> <p>192. Demonstrate different screws, nut-bolts, clamps, rivets and shackles used in lift and escalators. (15 hrs.)</p> <p>193. Demonstrate emergency safety devices used in elevators. (8 hrs.)</p> <p>194. Identify components of elevator. (10 hrs.)</p> <p>195. Demonstrate working of elevator. (10 hrs.)</p> <p>196. Demonstrate working of moving walkways. (9 hrs.)</p>	<p>Working principle of different elevators, types of conveying equipment.</p> <p>Importance of personnel safety in lifts and escalators.</p> <p>Applications and proper use of; Hard hat, Safety belt, lifeline, Barricade, Cut resistance gloves, goggles, dust musk, head lamp, ear plug, JHA, cardinal rules.</p> <p>Emergency equipment of the elevator; Emergency light, Automatic rescue device, door sensor, emergency alarm.</p> <p>Components of elevator; Types of elevator</p> <p>Capacity and speed of the Elevator.</p> <p>Moving walkways. (36hrs)</p>
Professional	Carry out	197. Practice Fixing of	Methods and procedure for

<p>Skill 250Hrs; Professional Knowledge 90Hrs</p>	<p>installation of elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings.</p>	<p>template. (10 hrs.) 198. Practice Fixing of bracket. (05 hrs.) 199. Practice Fixing of guide rail. (10 hrs.) 200. Demonstrate counter weight, buffer, car frame, emergency stop switch. (05 hrs.) 201. Demonstrate landing zone, top over travel. (8 hrs.) 202. Demonstrate over speed Governor, safety circuit, overhead clearance and car bottom clearance. (8 hrs.) 203. Demonstrate construction and parts of different elevators. (05 hrs.) 204. Demonstrate different types of elevator well/ pit. (05 hrs.) 205. Practice fixing of Guide rails, reed switch, magnet and observe running clearance. (10 hrs.) 206. Perform fixing of ropes/belt and limit switches. (10 hrs.) 207. Carry out inspection of car top. (10 hrs.) 208. Perform fixing and checking of electromagnet brake. (10 hrs.) 209. Fix cams and pulleys. (10</p>	<p>Template setting. Hoist way measurement, Bracket measurement &amp; fixing. Guide rail hoisting &amp; plumbing. Concept of counter weight, buffer, car frame, emergency stop switch. Different types of door, landing zone, top over travel, head room, etc. Elevator safety (over speed Governor, safety circuit, overhead clearance, car bottom clearance) Common safety features of elevator - ATT, overload, ISC, fire, earth quake. Types of elevator; passenger elevator, service elevator, freight elevator. Concept of elevator well, elevator pit, pit depth. Types and procedure of fixing Guide rails, reed switch magnet. Importance of Running clearance. Types of Ropes, Coated steel belt. Types of limit switch and their application. Importance of car top Inspection. Electromagnetic brakes for lifts. Types of Drum, pulleys, guiding shoes, cam, toe</p>
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		<p>hrs.)</p> <p>210. Demonstrate fixing of machine beam and beam support. (8 hrs.)</p> <p>211. Demonstration fixing of spur gear, worm gear and Bearings. (5 hrs.)</p> <p>212. Practice fixing of car components. (10 hrs.)</p> <p>213. Practice fixing of car lighting and fan. (2 hrs.)</p> <p>214. Fix and adjust compensation chain and governor tension weight. (12 hrs.)</p> <p>215. Demonstrate and practice of installation of door. (8 hrs.)</p> <p>216. Demonstrate and practice of installation of cage. (10 hrs.)</p> <p>217. Practice fitting of rope. (8 hrs.)</p> <p>218. Practice installation of travelling cable. (15 hrs.)</p> <p>219. Demonstrate safe use of scaffolding. (5 hrs.)</p> <p>220. Prepare check of list and report for commissioning. (5 hrs.)</p> <p>221. Prepare documents for getting license. (2 hrs.)</p> <p>222. Carry out testing of wiring circuit and motor before commissioning. (15 hrs.)</p> <p>223. Perform inspection run and normal run. (8 hrs.)</p> <p>224. Practice installation of</p>	<p>guard, retiring cam, limit cam and sheave used in lift.</p> <p>Process of fixing Machine beam and beam support.</p> <p>Dead end hitch, spur gear, worm gear and Bearings.</p> <p>Difference between Geared and Gearless machine.</p> <p>Components of Car Operating Panel.</p> <p>Hall fixture and lantern.</p> <p>Compensation chain, cage bulldog clip, governor tension weight and counter screen.</p> <p>Types of Doors and procedure of installation.</p> <p>Cage fitting, function of isolation.</p> <p>Concept and calculation of roping/ run by (1:1 , 2:1, 4:1)</p> <p>Procedure of travelling cable installation.</p> <p>Types scaffolding &amp; their standards.</p> <p>Concept of scaffoldless installation system.</p> <p>Commissioning; Concept, Procedure/ steps.</p> <p>Procedure of getting elevator license and commissioning certificate.</p> <p>Procedure, Types of governor and pulley, types of Car gate, etc.</p> <p>Space required for the erection of lift of different capacity.</p> <p>Required car area according to No. of passengers.</p>
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		<p>different types of ropes, guide, buffers, counter weight, etc. (15 hrs.)</p> <p>225. Practice installation of governor and pulley. (10 hrs.)</p> <p>226. Practice installation of car gate. (8 hrs.)</p> <p>227. Calculate car area for different No. of passengers. (2 hrs.)</p> <p>228. Calculate elevator speed for different applications. (4 hrs.)</p> <p>229. Calculate capacity of elevator (Kg) as per No. of passengers. (2 hrs.)</p>	<p>Selection of elevator speed for various types of lift.</p> <p>Capacity of elevator;</p> <p>Selection of location of Lift Machine.</p> <p>Selection of rope, guide rail, buffers, counters weight etc.</p> <p>Systematic installation. (90hrs)</p>
<p>Professional Skill 125 Hrs;</p> <p>Professional Knowledge 45 Hrs</p>	<p>Carry out installation of escalators and moving walkways in industries, shopping malls, subway stations and airport.</p>	<p>230. Demonstrate different escalator arrangements. (10 hrs.)</p> <p>231. Demonstrate moving walkways. (10 hrs.)</p> <p>232. Practice calculation of boarding and alighting areas for different sizes and types of escalators. (15 hrs.)</p> <p>233. Practice calculation of pit area and support requirements. (10 hrs.)</p> <p>234. Demonstrate different parts of step and step chain assembly. (15 hrs.)</p> <p>235. Demonstrate comb plate and hand rail parts. (10 hrs.)</p> <p>236. Practice fixing of drive unit, drive chain and shaft. (20 hrs.)</p>	<p>Types of Escalator arrangements; parallel, multiple parallel, cross over.</p> <p>Typical applications</p> <p>Moving walkways and applications.</p> <p>Selection/ Calculation of - speed, step widths, inclination</p> <p>Boarding and alighting areas, Pits and supports</p> <p>Components/ Parts of escalators.</p> <p>Step parts and assemblies</p> <p>Step chain parts and assemblies, Comb plate parts</p> <p>Hand rails and related parts.</p> <p>Motors and brake assemblies, Drive unit, drive chain and shafts.</p> <p>Lubrication system and other miscellaneous parts.</p>

		<p>237. Practice fixing of different covers and panels. (20 hrs.)</p> <p>238. Practice fixing of barriers and caution plates. (15 hrs.)</p>	<p>Covers, Decking, trim plates, panels, etc.</p> <p>Barriers, barrier assembly and caution plates.(45hrs)</p>
<p>Professional Skill 150Hrs;</p> <p>Professional Knowledge 54 Hrs</p>	<p>Install various electrical and electronic control devices, safety devices, control panels, limit switches and power wiring, etc. for control drives of lifts and escalators.</p>	<p>239. Demonstrate different control systems used in elevators. (10 hrs.)</p> <p>240. Identify different components of control circuits. (8 hrs.)</p> <p>241. Practice installation of various controls. (15 hrs.)</p> <p>242. Practice fixing of different electrical equipment and controls. (15 hrs.)</p> <p>243. Demonstrate the automatic levelling devices and their function with change of load. (10 hrs.)</p> <p>244. Set parameters and practice various operations. (15 hrs.)</p> <p>245. Practice manual and automatic push bottom operation. (10 hrs.)</p> <p>246. Demonstrate auxiliary motor micro drive. (7 hrs.)</p> <p>247. Demonstrate automatic levelling with main motor at various speeds. (5 hrs.)</p> <p>248. Identify different alarming modes. (5 hrs.)</p> <p>249. Practice reading of control circuit</p>	<p>Various control systems of lift and their utility.</p> <p>Rheostatic control and variable voltage control.</p> <p>Single speed, double speed and logic circuit control.</p> <p>Automatic levelling with change of load.</p> <p>Auxiliary motor micro drive.</p> <p>Electrical and control parts</p> <p>Automatic levelling with main motor at various speeds</p> <p>Automatic levelling devices.</p> <p>The floor selector type, hoist-way switching devices.</p> <p>Operation without mechanical contact.</p> <p>Manual operation, Push bottom,</p> <p>Automatic operation holds in push bottom operation, fully automatic push button operation, dual operation and signal operation.</p> <p>Alarming system</p> <p>Various electrical &amp; electronic control circuits.</p> <p>Logic circuits used in lifts.</p> <p>Test and trial of mechanical, electrical and electronic system of lift.</p> <p>Procedure of testing with minimum to maximum level.</p>

		<p>diagram.(10 hrs.)</p> <p>250. Inspect and check performance during test and trials. (8 hrs.)</p> <p>251. Make records of observation during trials. (10 hrs.)</p> <p>252. Practice alteration and adjustment as necessary. (7 hrs.)</p> <p>253. Simulate common defects and practice of repair. (15 hrs.)</p>	(54hrs)
<p>Professional Skill 225 Hrs;</p> <p>Professional Knowledge 81 Hrs</p>	<p>Carry out preventive &amp; breakdown maintenance of lifts, escalators and moving walkways with due care and safety.</p>	<p>254. Practice a good housekeeping while working in the lifts. (10 hrs.)</p> <p>255. Practice of safe working in lifts. Follow electrical safety rules. (20 hrs.)</p> <p>256. Demonstrate safety practices while working on live controller. (15 hrs.)</p> <p>257. Demonstrate safety practices while working on top of the car &amp; lift pit. (15 hrs.)</p> <p>258. General awareness on public safety components and door safety. (10 hrs.)</p> <p>259. Demonstrate use of personnel protective equipment. (10 hrs.)</p> <p>260. Measure and adjust clearance between wall and car. (25 hrs.)</p> <p>261. Measure and adjust</p>	<p>Safety of personnel, Safe use of hand &amp; power tools.</p> <p>Proper method of hand lifting rigging and hoisting.</p> <p>Proper use of ladders and step Ladders.</p> <p>Clothing, safety shoes, safety glasses, Safety belt, hand-protective Cream, leather gloves. Hard hats, Safety net etc.</p> <p>Proper use of ladders step Ladders.</p> <p>Clothing, safety shoes, safety glasses, Safety belt, hand-protective Cream, leather gloves. Hard hats, Safety net etc.</p> <p>Size and shape of car</p> <p>Clearance and allowances between car and the wall. (45 hrs)</p>

		clearance between adjacent cars. (20 hrs.)	
		<p>262. Check physical location of all components of lift as per drawing. (5 hrs.)</p> <p>263. Practice repairing and replacement of different mechanical components. (25 hrs.)</p> <p>264. Practice repairing and replacement of different electrical and electronic components. (25 hrs.)</p> <p>265. Check physical location of all components of escalators and moving walkways as per drawing. (10 hrs.)</p> <p>266. Carry out servicing of various mechanical and electrical parts of escalators and moving walkways as per drawing. (20 hrs.)</p> <p>267. Practice draining out of old grease and oils. (5 hrs.)</p> <p>268. Practice refilling of oil dashpots and grease cups. (5 hrs.)</p> <p>269. Lubrication on car gate, cam bellows, buffer, rope, guiderail etc. (5 hrs.)</p>	<p>Concept of lift maintenance. Methods/ Types of maintenance.</p> <p>Preparing check list.</p> <p>Concept of maintenance schedule.</p> <p>Preparing and follow-up of maintenance schedule.</p> <p>Preventive maintenance, running maintenance and brake-down maintenance.</p> <p>Spare parts used for lift and escalators maintenance.</p> <p>Inventory/ stocking of spare parts.</p> <p>Preservation of spare parts.</p> <p>Types of lubricants, its properties and use in lifts.</p> <p>Importance of lubrication.</p> <p>Lubrication during installation and periodical lubrication.</p> <p>Disadvantage of improper lubrication.</p> <p>(36 hrs)</p>
Professional Skill150Hrs;	Carry out various checks, testing, tuning of	270. Check lift's main supply, switches, fuses and contacts. (5 hrs.)	Effects of faulty power supply, i.e. single phasing, loose contact, improper

<p>Professional Knowledge 54 Hrs</p>	<p>components, examine safety devices and ensure proper functioning of lifts, escalators and moving walkways.</p>	<p>271. Examine &amp; adjust all moving contacts of the controller. (6 hrs.)  272. Tightening connections and secure wires. (5 hrs.)  273. Check motor connections brush position, air gap, bearing etc. (5 hrs.)  274. Check brake shoe, magnetic coil, oil in magnet case, dash pot adjustment etc. (8 hrs.)  275. Check oil level at worm gear, replace oil if necessary. (5 hrs.)  276. Check shaft bearing, drum, drive sheave for excessive play &amp; proper lubrication. (6 hrs.)  277. Careful examine safety governor for proper operating condition and lubrication. (6 hrs.)  278. Carefully examine all ropes for any damage and broken wire and proper lubrication. (6 hrs.)  279. Examine main &amp; counter weights, guide rail for lubrication and efficient functioning of brackets and rail clips. (8 hrs.)  280. Check car shoes, buffers and its lubricants. (5 hrs.)  281. Carefully examine safety devices, tripping rod for its setting (set even). (6 hrs.)</p>	<p>voltage etc.  Effect of wrong brush bedding and positioning.  Effects faulty and loose braking system.  Different types of bearings used in lift, their specification and properties.  Gear, worm and worm wheel used in lift and their function.  Function of various parts of governor.  Types of spring, function and use.  Concept of wear and tear.  System of levelling and alignment.  Types of Shaft and shaft coupling.  Function of emergency cut out in trip system.  Necessity of electrical/mechanical interlocks.  Importance of regular cleaning, dusting and lubrication.  Importance of recording parameters and other service records of lift.  Explanation and function of Auto rescue device (ARD).  (54hrs)</p>
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		<p>282. Check levelling of car platform. (5 hrs.)</p> <p>283. Check emergency opening of door and other emergency safety devices. (5 hrs.)</p> <p>284. Check movement of travelling cables for foul. (8 hrs.)</p> <p>285. Examine top and bottom final shaft way limit switches and other limit switches for their proper operation. (8 hrs.)</p> <p>286. Renew contacts or replace limit switches if required. (5 hrs.)</p> <p>287. Examine safety plank switch under car platform. (6 hrs.)</p> <p>288. Examine door contacts and gate contacts, adjusting and renewing parts where necessary. (5 hrs.)</p> <p>289. Examine emergency cut out switches for door and gate contacts. (5 hrs.)</p> <p>290. Examine light &amp; fan switches and fixture in the car for proper operation. (5 hrs.)</p> <p>291. Perform cleaning of top, bottom and inside car, lift pit, governor, machine, controller and other parts. (5 hrs.)</p> <p>292. Check machine room for</p>	
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		<p>proper cleanliness. (5 hrs.)</p> <p>293. Check proper functioning of relays, timers, signalling system, alarming system, indications, electrical interlocks etc. (8 hrs.)</p> <p>294. Prepare servicing report and make records of operational state and recommendation if any. (5 hrs.)</p> <p>295. Demonstrate Auto Rescue Device operating system and connection to lift System. (4 hrs.)</p>	
<p><b>Project work / Industrial visit</b></p> <p><b>Broad Area:</b></p> <ul style="list-style-type: none"> <li>a) Control system of lift/ escalators</li> <li>b) Safety devices</li> <li>c) Servicing report</li> <li>d) Prepare maintenance schedule</li> </ul>			

<b>SYLLABUS FOR CORE SKILLS</b>	
1.	Workshop Calculation & Science (Common for two year course) (80 hrs. + 80 hrs)
2.	Engineering Drawing (Common for Group-II (Electrical, Electronics & IT Trade Group))(80 hrs. + 80 hrs)
3.	Employability Skills (Common for all CTS trades) (160 hrs. + 80 hrs)

*Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in [www.bharatskills.gov.in](http://www.bharatskills.gov.in)*

<b>List of Tools &amp; Equipment</b>			
<b>LIFT AND ESCALATOR MECHANIC (For batch of 24Candidates)</b>			
<b>S No.</b>	<b>Name of the Tools and Equipment</b>	<b>Specification</b>	<b>Quantity</b>
<b>A. TRAINEES TOOL KIT</b>			
1.	Steel Tape	5 m length	24+1 Nos.
2.	Plier Insulated	150 mm	24+1 Nos.
3.	Plier Side Cutting	150 mm	24+1 Nos.
4.	Screw Driver	100 mm	24+1 Nos.
5.	Screw Driver	150 mm	24+1 Nos.
6.	Electrician Connector, screw driver insulated handle thin stem	100 mm	24+1 Nos.
7.	Heavy Duty Screw Driver	200 mm	24+1 Nos.
8.	Electrician Screw Driver thin stem insulated handle	250 mm	24+1 Nos.
9.	Punch Centre	150 mm x 9 mm	24+1 Nos.
10.	Knife Double Bladed Electrician		24+1 Nos.
11.	Neon Tester		24+1 Nos.
12.	Steel Rule	300 mm	24+1 Nos.
13.	Hammer, cross peen with handle		24+1 Nos.
14.	Hammer, ball peen With handle		24+1 Nos.
15.	Gimlet	6 mm	24+1 Nos.
16.	Bradawl		24+1 Nos.
17.	Scriber (Knurled centre position )		24+1 Nos.
18.	Pincer	150 mm	24+1 Nos.
<b>B. SHOP TOOLS, INSTRUMENTS – For 2 (1+1) units no additional items are required</b>			
19.	First aid box		01 set
20.	C- Clamp	200 mm, 150 mm and 100 mm	02 Nos. each
21.	Spanner Adjustable	150 mm,300mm	02 Nos. each
22.	Blow lamp	0.5 ltr	01 No.
23.	Vernier Caliper		01 No.
24.	Pressure Guage	Air	01No.
25.	Chisel Cold firmer	25 mm X 200 mm	02 Nos.
26.	Chisel	25 mm and 6 mm	02 Nos. each
27.	Hand Drill Machine		01 No.
28.	Portable Electric Drill Machine	6 mm	01 No.
29.	capacity		01 No.
30.	Pillar Electric Drill Machine	12 mm capacity	01 No.

31.	Allen Key		01 set
32.	Oil Can	0.12 ltr	01 No.
33.	Grease Gun		01 No
34.	Out Side Micrometer		02 Nos.
35.	Motorised Bench Grinder		01 No.
36.	Rawl plug tool and bit		02 set
37.	Pully Puller		02 Nos.
38.	Bearing Puller		02 Nos.
39.	Pipe vice		04 Nos.
40.	Thermometer	0 to 100 deg Centigrade	01 No.
41.	Scissors blade	150 mm	04 Nos.
42.	Crimping Tool		02 sets
43.	Wire stripper	20 cm	02 Nos.
44.	Chisel Cold flat	12 mm	02 Nos.
45.	Mallet hard wood	0.50 kg	04 Nos.
46.	Hammer Extractor type	0.40 kg	04 Nos.
47.	Hacksaw frame	200 mm 300 mm adjustable	02 Nos. each
48.	Try Square	150 mm blade	04 Nos.
49.	Outside and Inside Divider Calipers		02 Nos. each
50.	Pliers flat nose	150 mm	04 Nos.
51.	Pliers round nose	100 mm	04 Nos.
52.	Tweezers	100 mm	04 Nos.
53.	Snip Straight and Bent	150 mm	02 Nos. each
54.	D.E. Metric Spanner	6 to 32 mm	02 Nos.
55.	Drill hand brace		04 Nos.
56.	Drill S.S. Twist block	2 mm, 5 mm 6 mm set of 3	04 Set
57.	Plane, smoothing cutters	50 mm	02 Nos. each
58.	Gauge, wire imperial		02 Nos.
59.	File flat	200 mm 2 <sup>nd</sup> cut	12 Nos.
60.	File half round	200 mm 2 <sup>nd</sup> cut	04 Nos.
61.	File round	200 mm 2 <sup>nd</sup> cut	04 Nos.
62.	File flat	150 mm rough	04 Nos.
63.	File flat	250 mm bastard	04 Nos.
64.	File flat	250 mm smooth	04 Nos.
65.	File Rasp, half round	200 mm bastard	04 Nos.
66.	Soldering Iron	25 watt, 65 watt, 125 watt	02 Nos. each
67.	Copper bit soldering iron	0.25 kg.	02 Nos.
68.	Desoldering Gun		04 Nos.
69.	Hand Vice	50 mm jaw	04 Nos.
70.	Table Vice	100 mm jaw	12 Nos.
71.	Pipe Cutter to cut pipes	upto 5 cm. dia	04 Nos.

72.	Pipe Cutter to cut pipes	above 5 cm dia	02 Nos.
73.	Stock and Die set	for 20 mm to 50 mm G.I.	01 set
74.	pipe		As Required
75.	Stock and Dies conduit		01 No.
76.	Ohm Meter; Series Type & Shunt Type		02 Nos. each
77.	Multi Meter (analog)	0 to 1000 M Ohms, 2.5 to 500 V	02 Nos.
78.	Digital Multi Meter		06 Nos.
79.	A.C. Voltmeter M.I.	0 -500V A.C	01 No.
80.	Milli Voltmeter centre zero	100 - 0 - 100 m volt	01 No.
81.	D.C. Milli ammeter	0 -500m A	01 No.
82.	Ammeter MC	0-5 A, 0- 25 A	01 No. each
83.	A.C. Ammeter M.I.	0-5A, 0-25 A	01 No. each
84.	Kilo Wattmeter	0-1-3 KW	01 No.
85.	A.C. Energy Meter	Single phase 5 amp. Three Phase 15 amp	01 No. each
86.	Power Factor Meter		01 No.
87.	Frequency Meter		01 No.
88.	Flux meter		01 No.
89.	Wheat Stone Bridge with galvanometer and battery		01 No.
90.	Laboratory Type Induction Coil		01 No.
91.	DC Power Supply	0-30V, 2 amp	01 No.
92.	Rheostat	0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 1 Amp 0- 300 Ohm, 1 Amp	01 No. each
93.	Variable Auto Transformer	1 Phase	01 No.
94.	Battery Charger		01 No.
95.	Hydrometer		01 No.
96.	Miniature Breaker	16 amp (Raw Material)	01 No.
97.	Mini Drafter		12 Nos.
98.	Drawing Compass set		04 Nos.
99.	Dial gauge		02 Nos.
100.	Chain pulley block	2 ton	01 No.
101.	Shackle		02 Nos.
102.	Ceiling rope nylon/steel		50 mtr
103.	Control transformer single phase	250 W With 12v, 24v, 48v, 110v and 240v tapping	01No.
104.	Single phase transformer	1 KVA with enclosure and input/output terminals	01 No.
105.	Current transformer	50/5, 20/5, 20/1 ampere	01 each
106.	Potential transformer	240/110, 415/110 volt	01 each

107.	Analog/Digital converter	with four input/output	02 Nos.
108.	Digital /Analog converter	with four input/output	02 Nos.
109.	Soft starter	3 phase, 415 V, 15 A	01 No.
110.	Slings	2 ton capacity	01 No.
111.	Elevator rope cutter	upto 32mm	02 Nos.
112.	Elevator limit switches		04 Nos.
113.	Electric Hammer type drill machine 22mm capacity with all accessories	750W, 240V	01 No.
114.	Electric Hand grinding machine with 110 mm wheel diameter	750W, 240V	01 No.
115.	Electric hand blower	750 W, 240V	01 No.
116.	Rail alignment gauge		02 Nos.
117.	Working Plank	10 x 15 inch	04 Nos.
<b>C. General Machinery &amp; Equipment</b>			
118.	Mini welding machine - (With connecting cable, electrode holder, earthing clamp, safety glass and safety gloves)	150A, 240V	01 No.
119.	Elevator control panel suitable for 5/8 passenger lift having separate input, output and cable alley chamber. Fitted with PLC controller and related accessories		01 No.
120.	DC compound motor with switch fuse unit, voltmeter, ammeter, field regulator, armature regulator and four point starter	2 KW, 220V	01 No.
121.	Single phase capacitor start induction motor with starting panel	1KW, 240V	01 No.
122.	Universal motor with starting panel	0.75 KW, 240V	01 No.
123.	Three phase Squirrel cage induction motor with DOL starting panel	3 KW, 415 V	01 No.
124.	Synchronous permanent magnet motor with starting panel - (can be used as generator when coupled with DC compound motor)	2 KW, 3 phase, 415 V	01 No.
125.	Digital AC drive trainer	3 Phase, 2 KW	01 No.
126.	Servo motor Trainer	250 W, 220/110 V	01 No.
127.	Desktop multimedia computer - With suitable UPS and computer table	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and	01 No.

		Monitor (Min. 17 Inch. Licensed Operating System and Antivirus compatible with trade related software.	
128.	Working model of Escalator		01 No.
129.	Electromagnet break assembly		01 No.
130.	Over speed governor for passenger lift		01 No.
131.	Door simulator set (car door, landing door and door drive unit)		01 No.
132.	5/8 Passenger lift installed with all control and safety accessories		01 No.

#### D. Safety Equipment

133.	Industrial safety hat		04 Nos.
134.	Industrial safety shoe	different size	04 Nos.
135.	Fall arrest personnel safety belt		04 Nos.
136.	Life line rope - nylon braided made from high tenacity multifilament yarn	13 mm dia.	04 Nos.
137.	Safety net 3 x 3 meter		02 Nos.
138.	Head lamp 3 W with battery		02 Nos.
139.	Fire Extinguisher	CO <sub>2</sub> , 2 KG	02 Nos.
140.	Fire Buckets	With Stand	02 Nos.

#### E. Furniture & Accessories

141.	Instructor's table		01 No.
142.	Instructor's chair		02 Nos.
143.	Working Bench	2.5 m x 1.20 m x 0.75 m	04 Nos.
144.	Metal Rack	100cm x 150cm x 45cm	04 Nos.
145.	Lockers with 16 drawers standard size		02 Nos.
146.	Almirah	2.5 m x 1.20 m x 0.5 m	01 No.
147.	Black board/white board		01 No.
148.	Welding Table		01 No.

#### Note: -

1. All the tools and equipment are to be procured as per BIS specification.
2. If two units are working simultaneously in any shift, additional items under "Shop Tools, Instruments & Outfit" is required for second unit.
3. For each two units in a shift, one set of items under "**Machinery & Equipment**" are required.
4. Internet facility is desired to be provided in the class room.

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

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

<b>LIST OF TRADE EXPERTS, CORE GROUP MEMBERS &amp; MENTOR COUNCIL MEMBERS</b>			
<b>S No.</b>	<b>Name &amp; Designation Sh./Mr./Ms.</b>	<b>Organization</b>	<b>Remarks</b>
1.	Dr. S.P. Gupta, Professor	IIT Roorkee,	Chairman
2.	R.N. Bandopadhyay, Director	CSTARI, Kolkata	Member
3.	R. Senthil Kumar Director	ATI, Chennai	Member
4.	A Venkateshwara Rao, Joint Director	ATI, Chennai	Member
5.	P. Saibaba, Joint Director	ATI, Chennai	Member
6.	K.L. Kuli, Joint Director	CSTARI, Kolkata	Member
7.	K. Srinivasa Rao, Joint Director	CSTARI, Kolkata	Member
8.	M. Thamizharasan, Joint Director	CSTARI, Kolkata	Member
9.	S. Mathivanan, Dy Director	ATI, Chennai,	Team Leader
10.	Amrit Pal Singh, Dy. Director	DGET, New Delhi	Mentor
11.	B.N. Sridhar, Dy Director	FTI, Bangalore	Member
12.	Ketan Patel, Dy Director	RDAT, Mumbai	Member
13.	B. Ravi, Dy Director	CTI, Chennai	Member
14.	A.S. Parihar, Dy Director	RDAT, Kolkata	Member
15.	NirmalyaNath, Asst Director	CSTARI, Kolkata	Member
16.	Parveen Kumar, Asst Director	ATI-EPI, Hyderabad	Member
17.	C.C. Jose, Trg Officer	ATI, Chennai	Member
18.	L.M. Pharikal, Trg Officer	ATI, Kolkata	Member
19.	M. Asokan, Trg Officer	CTI, Chennai	Member
20.	Mohan Raj, Trg Officer	NIMI Chennai	Member
21.	U.K. Mishra, Trg Officer	ATI, Mumbai	Member
22.	C.M. Diggewadi, Trg Officer	RDAT, Mumbai	Member
23.	A. Chakraborty, Trg Officer	CSTARI, Kolkata	Member
24.	T.K. Ghosh, Trg Officer	CSTARI, Kolkata	Member
25.	Prasad U.M., Voc Instructor	MITI, Calicut	Member
26.	Gabriel Pradeep A.P., JTO	Govt ITI, Hosur Road,	Member

		Bangalore	
27.	Latha, JTO	Govt ITI, Hosur Road, Bangalore	Member
28.	D. Viswanathan, ATO	Govt ITI, North Chennai	Member
29.	B. Navaneedhan, ATO	ITI, North Chennai	Member
30.	R. Rajasekar, ATO	ITI, Ambattur, Chennai	Member
31.	K. Amaresan, ATO	Govt ITI, Guindy, Chennai	Member
32.	Dr.P. Mahanto, Professor	IIT, Guwahati	Member
33.	K.K. Seth, Ex. Director	BHEL, Noida	Member
34.	N. Chattopadhyay, Sr. DGM	BHEL, Kolkatta	Member
35.	SurenduAdhikari	OTIS Elevator Co. India Ltd, Kolkata	Member
36.	K. Raju, Consultant	Energy Area, ASCI, Hyderabad	Member
37.	Ravi G Deshmukh, Certified Energy Auditor	PPS Energy solutions, Pune	Member
38.	R. Thiruppathi, JTS	IIT, Madras, Chennai	Member
39.	M.N. Krishnamurthy, Retd. Engineer	TNEB, Chennai	Member
40.	S. Kirubanandam, Asst. Engineer	TANTRANSCO, Chennai	Member
41.	R. Kasi, Asst. Ex Engineer	TANTRANSCO, Chennai	Member
42.	L.R. Sundarajan, Jr. Works Manager	Heavy vehicles factory	Member
43.	B.S. Sudheendara, Consultant	VI micro systems pvt ltd, Chennai	Member
44.	S. Ganesh, Manager	L&T, Chennai	Member
45.	Neethimani, Vice principal	Rane engine valves ltd, Chennai	Member

### ABBREVIATIONS

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

