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

COMPETENCY BASED CURRICULUM

LIFT AND ESCALATOR MECHANIC

(Duration: Two Years)
Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

SECTOR – POWER

Directorate General of Training

LIFT AND ESCALATOR MECHANIC

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

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NSQF LEVEL- 4

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

During the two-year duration of Lift and Escalator Mechanic trade a candidate is trained on professional skill, professional knowledge 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, TRAIC, 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 devicesof 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. TRAINING SYSTEM

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 (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	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	840	840
2	Professional Knowledge (Trade Theory)	240	300
3	Employability Skills	120	60
	Total	**1200**	**1200**

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

One the Job Training (OJT)/ Group Project	150	150

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses.

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

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%.

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 assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude to be considered while assessing competency.

Assessment will be evidence based comprising some of 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
- Computer based multiple choice question examination
- Practical Examination

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

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while

due regard for safety procedures and practices	undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Marks in the range of 75%-90% to be allotted during assessment	
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	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Marks in the range of more than 90% to be allotted during assessment	
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.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

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 suchas 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 filled 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

Reference NOS: --

a) PSS/N9415
b) PSS/N9416
c) PSS/N9417
d) PSS/N9418
e) PSS/N9419
f) PSS/N9420
g) PSS/N9421
h) PSS/N9422
i) PSS/N9423
j) PSS/N9424
k) PSS/N9425
l) PSS/N9426
m) PSS/N9427
n) PSS/N9401
o) PSS/N9402
p) PSS/N9428
q) PSS/N9429
r) PSS/N9430
s) PSS/N9431
t) PSS/N9432
u) PSS/N9433
v) PSS/N9401
w) PSS/N9402

4. GENERAL INFORMATION

Name of the Trade	**LIFT AND ESCALATOR MECHANIC**
Trade Code	DGT/1074
NCO - 2015	7411.0100, 7412.0200, 8343.1800, 7411.9900
NOS Covered	PSS/N9415, PSS/N9416, PSS/N9417, PSS/N9418, PSS/N9419, PSS/N9420, PSS/N9421, PSS/N9422, PSS/N9423, PSS/N9424, PSS/N9425, PSS/N9426, PSS/N9427, PSS/N9401, PSS/N9402, PSS/N9428, PSS/N9429, PSS/N9430, PSS/N9431, PSS/N9432, PSS/N9433, PSS/N9401, PSS/N9402
NSQF Level	Level-4
Duration of Craftsmen Training	Two Years (2400 hours + 300 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, DEAF, LV
Unit Strength (No. Of Student)	24 (There is no separate provision of supernumerary seats)
Space Norms	98.6 Sq. m
Power Norms	6 KW
Instructors Qualification for	
(i) Lift & Escalator Mechanic Trade	B.Voc/Degree in Electrical/ Electrical and Electronics Engineering from AICTE/UGC recognized engineering college/ university with one year experience in the relevant field. **OR** 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. **OR** NTC/NAC passed in the Trade of "Lift and Escalator Mechanic" with 3 years experience in the relevant field. **<u>Essential Qualification</u>:** Relevant Regular / RPL variants of National Craft Instructor

	Certificate (NCIC) under DGT. ***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.***
(ii) Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 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. **OR** NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants NCIC in RoDA or any of its variants under DGT
(iii) Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 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. **OR** NTC/ NAC in any one of the Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants of NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.
(iv) Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)

	OR Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.
(v) Minimum Age for Instructor	21 Years
List of Tools & Equipment	As per Annexure-I

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES (TRADE SPECIFIC)

FIRST YEAR:

1. Use carpentry tools and undertake basic carpentry work following safety precautions. (NOS: PSS/N9415)
2. Undertake basic fitting operations and use various instruments/ gauges to check different parameters. (NOS: PSS/N9416)
3. Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance. (NOS: PSS/N9417)
4. Select and use AC/ DC measuring instruments, measure electrical parameters and verify characteristics of electrical/ magnetic circuits. (NOS: PSS/N9418)
5. Carry out Installation, testing and maintenance of batteries. (NOS: PSS/N9419)
6. Carry out wiring, assembling of electrical accessories and earthing of electrical equipment. (NOS: PSS/N9420)
7. Assemble simple electronic circuits and test for functioning. (NOS: PSS/N9421)
8. Undertake basic civil/ drafting work, draw plane figures used in lifts and escalator by applying drawing instruments with proper layout. (NOS: PSS/N9422)
9. Use lifting tools/ hoist equipment and perform simple welding & brazing. (NOS: PSS/N9423)
10. Carry out industrial wiring of control panels, assemble accessories and equipment as per BIS recommendations and IE rules. (NOS: PSS/N9424)
11. Install, connect, start, run, reverse and stop AC/ DC machines including synchronous motors and carry out maintenance along with protective and controlling devices. (NOS: PSS/N9425)
12. Assemble power electronic circuits and test for functioning including digital electronic components and circuits. (NOS: PSS/N9426)
13. Perform speed control of AC and DC motors by using solid state devices. (NOS: PSS/N9427)
14. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)

SECOND YEAR:

16. Carry out safe operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors. (NOS: PSS/N9428)
17. Carry out installation of elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings. (NOS: PSS/N9429)
18. Carry out installation of escalators and moving walkways in industries, shopping malls, subway stations and airport. (NOS: PSS/N9430)
19. Install various electrical and electronic control devices, safety devices, control panels, limit switches and power wiring, etc. for control drives of lifts and escalators. (NOS: PSS/N9431)
20. Carry out preventive & breakdown maintenance of lifts, escalators and moving walkways with due care and safety. (NOS: PSS/N9432)
21. Carry out various checks, testing, tuning of components, examine safety devices and ensure proper functioning of lifts, escalators and moving walkways. (NOS: PSS/N9433)
22. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)
23. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Use carpentry tools and undertake basic carpentry work following safety precautions. (NOS: PSS/N9415)	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. (NOS: PSS/N9416)	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. (NOS: PSS/N9417)	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. (NOS: PSS/N9418)	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. (NOS: PSS/N9419)	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. (NOS: PSS/N9420)	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. (NOS: PSS/N9421)	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 figures used in lifts and escalator by applying drawing instruments with proper layout. (NOS: PSS/N9422)	Construct plain geometrical figures.
	Draw three view in orthographic Projection of line, surfaces, solid objects.
	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. (NOS: PSS/N9423)	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. (NOS: PSS/N9424)	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. (NOS: PSS/N9425)	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. (NOS: PSS/N9426)	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. (NOS: PSS/N9427)	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.
14. Read and apply engineering drawing for different application in the	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material

field of work. (NOS: PSS/N9401)	requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study
SECOND YEAR	
16. Carry out safe operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors. (NOS: PSS/N9430)	Identify different types of elevators – Hydraulic/ Pneumatic/ Traction.
	Demonstrate use of Personnel safety equipment viz., hard hat, 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.
17. Carry out installation of elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings. (NOS: PSS/N9431)	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.
18. Carry out installation of escalators and moving walkways in industries, shopping malls, subway stations and airport. (NOS: PSS/N9432)	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.
19. Install various electrical and electronic control devices, safety devices, control panels, limit switches and power wiring, etc. for control drives of lifts and escalators. (NOS: PSS/N9433)	Identify different control systems used in elevators.
	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.
20. Carry out preventive & breakdown maintenance of lifts, escalators and moving walkways with due care and safety. (NOS: PSS/N9434)	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.
21. Carry out various checks, testing, tuning of components, examine safety devices and ensure proper functioning of lifts,	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.

escalators and moving walkways. (NOS: PSS/N9435)	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.
22. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
23. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

SYLLABUS FOR LIFT & ESCALATOR MECHANIC TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 65 Hrs; Professional Knowledge 14 Hrs	Use carpentry tools and undertake basic carpentry work following safety precautions. (Mapped NOS: PSS/N9415)	1. Visit various sections of the institutes and identify locations of different installations. (2 hrs.) 2. Identify safety symbols and hazards. (1 hr.) 3. Practice safe methods of fire fighting and use of fire extinguishers. (5 hrs.) 4. Locate all the first aid boxes in the institute and practice elementary first aid. (5 hrs.) 5. Practice to isolate electric supplies and rescue a person safely in contact with electricity. (7 hrs.) 6. Practice artificial respiration. (5 hrs.)	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. (04 hrs.)
		7. Demonstrate disposal procedure of waste materials. (4 hrs.) 8. Practice use of personal protective equipments. (5 hrs.) 9. Identify trade tools, machineries and different accessories pertaining to the trade. (6 hrs.) 10. Practice on cleanliness and	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. (04 hrs)

		procedure to maintain it. (4 hrs.) 11. Basic workshop on 5S concept and practices. (7 hrs.)	
		Allied Trades: 12. Drilling practice in hand drilling and power drilling machines. (6 hrs.) 13. Practice in using firmer chisel and preparing simple half lap joint. (8 hrs.)	Safety precautions to be observed. Description of files, hammers, chisels hacksaw frames and blades- their specification and grades. Study of various joints. Steel rule, try square and files. Marking tools description and use. (6 hrs)
Professional Skill 35 Hrs; Professional Knowledge 07 Hrs	Undertake basic fitting operations and use various instruments/ gauges to check different parameters. (Mapped NOS: PSS/N9416)	14. Practice in using snips, marking and cutting of straight and curved pieces in metal sheets. (3 hrs.) 15. Practice making holes, securing by screw and riveting. (2 hrs.) 16. Practice bending the edges of sheets metals. (4 hrs.) 17. Workshop practice on drilling, chipping, internal and external threading of different sizes. (6 hrs.) 18. Practice in using taps and dies, threading hexagonal and square nuts etc. cutting external threads on stud/ pipes and riveting practice. (6 hrs.) 19. Practice in making different joints in sheet metal in soldering the joints. (4 hrs.) 20. Prepare an open box from metal sheet. (5 hrs.)	Introduction of fitting trade. Marking tools; calipers Dividers, Surface plates, Angle plates, Scribers, punches, surface gauges Types, Uses, Care and maintenance. Use of different bench tools used by sheet metal worker. Description and types of taps and dies, Description of marking andcutting tools such as snubs shears punches and other tools like hammers, mallets, etc. used bysheet metal workers. 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. Introduction to

		21. Demonstrate measurement of temperature. (2 hrs.) 22. Measure air pressure and oil pressure using suitable gauges. (3 hrs.)	thermometers, pressure gauges etc. (7 hrs)
Professional Skill 60 Hrs; Professional Knowledge 15 Hrs	Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance. (Mapped NOS: PSS/N9417)	23. Demonstrate and identify trade hand tools with specifications. (5 hrs.) 24. Practice in using cutting pliers and screw drivers, etc. (4 hrs.) 25. Identify various types of cables and measure conductor size using SWG and micrometer. (06 hrs.) 26. Practice on skinning, twisting and prepare terminations of cable ends. (10 hrs.) 27. Practice on crimping thimbles and lugs. (8 hrs.) 28. Make simple twist, married, Tee and western union joints. (7 hrs.) 29. Make britannia straight, britannia Tee and rat tail joints. (10 hrs.) 30. Practice in Soldering of joints / lugs. (5 hrs.) 31. Test insulation resistance of different cables. (5 hrs.)	Fundamentals of electricity, Electron theory, definitions, units & effects of electric current. Definition and properties of conductors, insulators and semi-conductors. Wires/ cables & their specifications. Types of wire joints & uses. standard wire gauge Solders, flux and soldering technique. Types & properties of resistors Specific Resistance. Introduction of National Electrical Code Cable insulation & voltage grades, permissible temperature rise. Precautions in using various types of cables/ ferrules. Trade hand tools; Uses, care and maintenance. (15 hrs)
Professional Skill 130 Hrs; Professional Knowledge 30 Hrs	Select and use AC/DC measuring instruments, measure electrical parameters and verify characteristics of	32. Verify ohm's Law for different resistor values and voltage sources. (4 hrs.) 33. Verify Kirchhoff's Law for different voltage and current. (4 hrs.)	**Ohm's Law -** Simple electrical circuits and problems. **Resistors**-Laws of Resistance. Series, parallel and combination circuits. **Kirchoff's** Laws and

	electrical/ magnetic circuits. (Mapped NOS: PSS/N9418)	34. Verify laws of series and parallel circuits with voltage source in different combinations. (4 hrs.) 35. Measure current and voltage and analyse the effects of shorts and opens in series and parallel circuits. (6 hrs.) 36. Measure resistance using voltage drop method. (4 hrs.) 37. Measure resistance using wheatstone bridge. (4 hrs.) 38. Demonstrate the change in resistance of a metal with change in temperature. (5 hrs.) 39. Verify the characteristics of series parallel combination of resistors. (5 hrs.) 40. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits. (08 hrs.) 41. Measure the resonance frequency in AC series circuit and determine its effect on the circuit. (08 hrs.) 42. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits. (6 hrs.) 43. Measure power and energy in single phase circuits. (2 hr.)	applications. Wheatstone bridge principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance. **Alternating Current** - 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 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. **Measuring Instruments;** Classification, various types, viz., deflection type, recoding type and integrating type.

		44. Measure Voltage, Current, Power, Frequency, Energy and Power Factor in three phase circuit. (6 hrs.) 45. Measure electrical parameters using tong tester in three phase circuits. (6 hrs.) 46. Find the phase sequence of three phase system and identify the wires using phase sequence meter. (7 hrs.) 47. Practice on various analog and digital measuring Instruments viz., multimeter, megger, frequency meter, tachometer, clamp meter, etc. (10 hrs.)	Measurement of various electrical parameters using different analog and digital instruments. (20 hrs)
		48. Determine the poles and plot the field of a magnet bar. (2 hrs.) 49. Wind a solenoid and determine the magnetic effect of electric current. (4 hrs.) 50. Measure induced emf due to change in magnetic field. (3 hrs.) 51. Determine direction of induced emf and current. (2 hrs.) 52. Practice on generation of mutually induced emf. (4 hrs.) 53. Measure the resistance, impedance and determine inductance of choke coils in	**Magnetism -** classification of magnets, methodsof magnetizing magnetic materials. Properties, care and maintenance. Paramagnetic, diamagnetic and ferromagnetic materials. 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. B.H. curve, Hysteresis, Eddy current. Principle of electro-magnetic

		different combinations. (7 hrs.) 54. Identify various types of capacitors. (3 hrs.) 55. Demonstrate charging / discharging and testing of capacitors using DC voltage and lamp. (8 hrs.) 56. Group the given capacitors to get the required capacity and voltage rating. (8 hrs.)	Induction, Faraday's Law, Lenz's Law. Electrostatics: Capacitor- Different types, functions and uses. (10 hrs)
Professional Skill 65 Hrs; Professional Knowledge 12 Hrs	Carry out Installation, testing and maintenance of batteries. (Mapped NOS: PSS/N9419)	57. Demonstrate and identify different types of cells. (6 hrs.) 58. Undertake grouping of dry cells for specified voltage and current. (08 hrs.) 59. Carry out preparation for charging of batteries. (08 hrs.) 60. Practice on charging of Lead acid battery by different methods. (08 hrs.) 61. Check discharged and fully charged battery. (7 hrs.) 62. Carry out filling of electrolyte in lead acid battery. (8 hrs.) 63. Demonstrate installation of batteries. (8 hrs.) 64. Practice on routine, care/ maintenance and testing of batteries. (12 hrs.)	Chemical effect of electric current. Principle of electrolysis. Faraday's Law of electrolysis. Explanation of Anodes and Cathodes. Cells; Primary & Secondary Lead acid cell; description, methods of charging, Precautions to be taken & testing equipment. Ni-cadmium & Lithium cell, Different types of lead acid cells. Battery Charger, UPS, etc. Lead Acid cell, general defects and remedies. Nickel Alkali Cell-description, charging. Power and capacity of cells. Efficiency of cells. Rechargeable dry cell, description advantages and disadvantages. Grouping of cells for specified voltage and current. Sealed Maintenance free

			Batteries, Solar cell. Care and maintenance of cells. (12 hrs)
Professional Skill 35 Hrs; Professional Knowledge 06 Hrs	Carry out wiring, assembling of electrical accessories and earthing of electrical equipment. (Mapped NOS: PSS/N9420)	65. Demonstrate wiring accessories viz., switches, fuses, lamps, MCBs, etc. (5 hrs.) 66. Practice on installation and overhauling common electrical accessories. (06 hrs.) 67. Practice on fixing of switches, holder, plugs etc. in wooden/PVC/ Metallic boards. (06 hrs.) 68. Wire up a test board and check for it's functioning. (2 hrs.) 69. Practice of various types of electrical circuit connections such as one lamp, two lamp, three lamp with wall socket, stair case wiring, tube light connection etc. (06 hrs.) 70. Demonstrate earthing installations and measure earth resistance by earth tester / megger. (6 hrs.) 71. Test earth leakage by ELCB and relay. (4 hrs.)	Common Electrical wiring accessories, their specifications in line with NEC. Explanation of switches, lamp holders, plugs and sockets. Alarm & switches, Use & specification of Fire alarm, Fuses, MCB, ELCB, and MCCB. Developments of domestic circuits. **Earthing**- Principle and different methods of earthing i.e. Pipe and Plate earthing. Importance of Earthing. Improvement of earth resistanceEarth Leakage circuit breaker (ELCB). (06 hrs)
Professional Skill 30 Hrs; Professional Knowledge 06 Hrs	Assemble simple electronic circuits and test for functioning. (Mapped NOS: PSS/N9421)	72. Demonstrate and identify various active and passive components. (2 hrs.) 73. Determine the value of resistance by colour code and identify types. (4 hrs.) 74. Test active and passive electronic components. (3	**Basic electronics;** Resistors – colour code, types and characteristics. Active and passive components. Atomic structure and semiconductor theory. P-type and N-type materials.

		hrs.) 75. Determine V-I characteristics of semiconductor diode. (4 hrs.) 76. Construct half wave, full wave and bridge rectifiers using semiconductor diode. (6 hrs.) 77. Check transistors for their functioning by identifying its type and terminals. (4 hrs.) 78. Bias the transistor and determine its characteristics. (4 hrs.) 79. Use transistor as an electronic switch and series voltage regulator. (3 hrs.)	P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers and filters. Principle of operation, types, characteristics and various configuration of transistor. Application of transistor as a switch, voltage regulator and amplifier. (06 hrs)
Professional Skill 35 Hrs; Professional Knowledge 06 Hrs	Undertake basic civil/ drafting work, draw plane figures used in lifts and escalator by applying drawing instruments with proper layout. (Mapped NOS: PSS/N9422)	80. Practice drawing of Lines, lettering and dimensioning. (3 hrs.) 81. Construction of plain geometrical figures. (3 hrs.) 82. Construction of scales – Plain, comparative and diagonal. (1 hr.) 83. Practice drawing of three views in orthographic Projection of line, surfaces, solid objects & section of solids. (08 hrs.) Practice drawing of different types of foundation – (21 hrs.) Shallow: - 84. Spread Footing. 85. Grillage foundation. Deep: - 86. Pile foundation.	Definition and types of projections. Methods of projection as per IS. Projection of points, lines, planes and solids. Concept of brick well, RCC well Foundation: Types, Purpose & causes of failure of foundation. Drawing of footing foundation, excavation, shoring & simple machine foundations. (06 hrs)

		87. Raft foundation. 88. Well foundation. 89. Special foundation. 90. Demonstrate use of spirit level, water level and plum bob.	
Professional Skill 50 Hrs; Professional Knowledge 10 Hrs	Use lifting tools/ hoist equipment and perform simple welding& brazing. (Mapped NOS: PSS/N9423)	91. Demonstrate use of tape, dial gauge, scale, try square, etc. (6 hrs.) 92. Demonstrate & Practice of chain block, hoist, pulleys, shackle, ceiling and derricks etc. (10 hrs.) 93. Practice different types of knots. (4 hrs.) 94. Identify components used in arc welding. (5 hrs.) 95. Setup welding machine and practice arc welding. (5 hrs.) 96. Practice different welding joints. (10 hrs.) 97. Perform metal joining by brazing. (10 hrs.)	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. Types of joints in welding. Types of electrode. Safety measures in welding. (10 hrs)
Professional Skill 95 Hrs; Professional Knowledge 15 Hrs	Carry out industrial wiring of control panels, assemble accessories and equipment as per BIS recommendations and IE rules. (Mapped NOS: PSS/N9424)	104. Demonstrate various components of a control panel viz. DIN rails, plastic trunking, connector blocks and terminals etc. (05 hrs.) 105. Demonstrate various components of different relays and contactors their specifications, fittings in the control panel and labelling. (05 hrs.) 106. Identify transformers/	Indian Electricity rules pertaining to operation, construction and maintenance of Lifts and Escalators. Statutory provisions for getting license. Types of wires and cables used in lift. Wiring procedures and techniques, Types of switches for control & power wiring. Types of Thermostats, timers and mercury switches. Specification & ratings of

		toroidal inductors, resistors and capacitors their specifications, marking and fitment in the panels. (03 hrs.) 107. Identify various fuses, fuse holders, specifications and their fittings. (3 hrs.) 108. Identify various switches, push buttons, lamps used in control panels, their specifications and fitment in the panel. (4 hrs.) 109. Demonstrate various thermostats and timers. (5 hrs.) 110. Practice cable forming including template, binding, lacing, loop tie, lock stitch, breakouts, twisted pair etc. (10 hrs.) 111. Practice use of sleeves, bootlace ferrule, correct method of connections in terminal blocks and routing of cables. (10 hrs.) 112. Pass cables through strain relief plate in an Electrical cabinet and secure the cables properly using cable tie/clamp. (10 hrs.) 113. Practice fixing of bus bar and tapping connections from bus bar. (10 hrs.) 114. Perform connections of	MCB, MCCB, ELCB, ACB. Bus bars size and spacing Procedure for control panel erection. Single Phase Transformer; Types and Classification, specification and simple problems on e.m.f. equation, turns ratio and efficiency. Three Phase Transformer; Types & Connections. Check of list for Do's and Don’ts for operation and maintenance. (15 hrs)

		three phase transformer and control transformers (CT & PT). (10 hrs.) 115. Practice earthing and screening of cabinets as per IE rules and ensure proper earth continuity. (5 hrs.) 116. Practice mounting and connections of various control elements e.g. MCB, MCCB, relays, contactors, measuring instruments, sensors and timers etc. (10 hrs.) 117. Test the control panel for its proper functioning. (5 hrs.)	
Professional Skill 120 Hrs; Professional Knowledge 25 Hrs	Install, connect, start, run, reverse and stop AC/ DC machines including synchronous motors and carry out maintenance along with protective and controlling devices. (Mapped NOS: PSS/N9425)	118. Identify terminals, parts and connections of different types of DC machines. (7 hrs.) 119. Measure field and armature resistance of DC machines. (4 hrs.) 120. Start, run and reverse the direction of rotation of DC motor. (5 hrs.) 121. Perform speed control of DC motors - field and armature control method. (7 hrs.) 122. Conduct different tests on DC motors viz., swinburne's test, brake test, etc. (6 hrs.) 123. Perform no load and load test and determine characteristics of DC	DC machines; Principle of operation, Construction and types of DC motors and generators. Starting, Speed control methods, and efficiency. DC Generators; types, emf equation, armature reaction and commutation. Different characteristics of DC Generators. (10 hrs)

		generators. (8 hrs.) 124. Carry out maintenance on DC machines. (8 hrs.)	
		125. Verify terminals, identify components and calculate transformation ratio of single phase transformers. (04 hrs.) 126. Perform OC and SC test to determine and efficiency of single phase transformer. (03 hrs.) 127. Determine voltage regulation of single phase transformer at different loads and power factors. (06 hrs.) 128. Identify parts and terminals of an alternator. (03 hrs.) 129. Connect, start and run an alternator and build up the voltage and measure voltage and frequency. (06 hrs.) 130. Identify parts and terminals of different types of single phase AC motors. (04 hrs.) 131. Start, run and reverse the direction of rotation of single phase AC motors. (03 hrs.) 132. Practice on speed control of single phase AC motors. (6 hrs.) 133. Test different single phase AC motors. (04 hrs.)	Working principle, construction and classification of transformer. Single phase and three phase transformers. Turn ratio, Voltage Regulation and efficiency. Auto Transformer and instrument transformers (CT & PT). Principle of electromagnetic induction, Faraday's law, Lenz's law, Fleming's right /left hand rule. Single phase AC motors; Working principle, construction, Characteristics, testing, Starting methods and applications. Three phase induction motors; Characteristics & testing three phase induction motors, Starting methods and applications of poly phase induction motor. Common Motor control circuit elements; Start/ stop push buttons, indicators, contactors, etc. Simple drawings for starting and control circuit. Construction and working principle of synchronous motor. Construction and working principle of Permanent

		134. Connect and test three phase induction motor. (04 hrs.) 135. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters. (05 hrs.) 136. Connect and test different control elements as per drawing. (05 hrs.) 137. Identify terminals and connections of synchronous motor. (03 hrs.) 138. Identify terminals and connections of Permanent magnet synchronous motor. (04 hrs.) 139. Perform speed control of synchronous motor. (9 hrs.) 140. Carry out maintenance on AC machines. (6 hrs.)	magnet synchronous motorSize/ rating of motor applicable for lift and escalator. (15 hrs)
Professional Skill 60 Hrs; Professional Knowledge 12 Hrs	Assemble power electronic circuits and test for functioning including digital electronic components and circuits. (Mapped NOS: PSS/N9426)	141. Demonstrate simple power control circuit by SCR, and DIAC/TRIAC. (4 hrs.) 142. Demonstrate simple power control circuits using UJT, FET, JFET, MOSFET, IGBT. (5 hrs.) 143. Verify characteristics of SCR, DIAC, TRIAC, FET, etc. (6 hrs.) 144. Demonstrate and identify	Types of electronic power devices. Working principle of SCR, DIAC & TRIAC, GTO, UJT, FET, JFET, MOSFET, IGBT. Biasing FET as amplifier and switch. UPS, Inverter and Battery charger. Analog to Digital converter Digital to analog converter Various types of ICs, Buffer

		triggering circuits. (4 hrs.) 145. Construct simple circuits containing UJT for triggering. (4 hrs.) 146. Troubleshoot defects in simple power supply circuit. (5 hrs.) 147. Test, analyze defects and repair UPS. (6 hrs.) 148. Maintain, service and troubleshoot battery charger and inverter. (6 hrs.) 149. Install an Inverter with battery. (2 hrs.) 150. Identify pins of various ICs used in power electronic circuits. (2 hrs.) 151. Demonstrate functioning and checking of DA/ AD converters. (4 hrs.) 152. Check various registers, counters and timers. (2 hrs.) 153. Identify the different front panel control of a CRO. (4 hrs.) 154. Practice measuring of the Amplitude, Frequency and time period of typical electronic signals using CRO. (6 hrs.)	Applications of power electronic devices. Introduction to CRO Types of oscillators and multi-vibrators. Basic calculation in oscillators. Introduction to Digital electronics; Logic gates and ICs. Combinational circuits and its classification. Number system, Registers, Counters and Timers. Digital memory types; ROM, RAM, EPROM. (12 hrs)
Professional Skill 60 Hrs; Professional Knowledge 12 Hrs	Perform speed control of AC and DC motors by using solid state devices. (Mapped NOS: PSS/N9427)	155. Identify different parts of AC/ DC drive. (5 hrs.) 156. Identify terminals of AC/ DC drive. (7 hrs.) 157. Connect A/D and D/A converters with drive. (11 hrs.)	Types of AC/DC drives Functions and block diagram Terminal connections; control and power circuit. Applications of AC/DC drive, Basic parameter setting in variable voltage variable

		158. Connect and operate lift motor through VVVF drives. (07 hrs.) 159. Perform speed control of lift motor using drive. (09 hrs.) 160. Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive. (13 hrs.) 161. Connect and run stepper/ servo motor using electronic controller. (8 hrs.)	frequency (VVVF) drive. Size and selection of drives used in lifts and escalators. Study of Specific control logic for lift motor operation. Parameter settings of drives for lift motor operation. Interfacing of A/D and D/A converters with drive. Speed control of motor by thyristor. Concept of stepper/ servo motor. (12 hrs)
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 Hrs	Read and apply engineering drawing for different application in the field of work. (Mapped NOS: PSS/N9401)	**ENGINEERING DRAWING:** Introduction to Engineering Drawing and Drawing Instruments– • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Freehand drawing of • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke Dimensioning Practice • Types of arrowhead Symbolic representation– • Different electrical symbols used in the related trades Reading of Electrical Circuit Diagram Reading of Electrical Layout drawing	

Workshop Calculation & Science: 30 Hrs.		
Professional Knowledge WCS-30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: PSS/N9402)	**WORKSHOP CALCULATION & SCIENCE:** **Unit, Fractions** Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, substraction, multiplication & division Decimal fractions - Addition, subtraction, multilipication& division Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and suare root Simple problems using calculator Applications of pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Precentage - Changing percentage to decimal and fraction **Material Science** Types metals, types of ferrous and non ferrous metals Introduction of iron and cast iron **Mass, Weight, Volume and Density** Mass, volume, density, weight Related problems for mass, volume, density, weight Work, power, energy, HP, IHP, BHP and efficiency Potential energy, kinetic energy and related problems with assignment **Heat & Temperature and Pressure** Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Scales of temperature, celsius, fahrenheit, kelvin and conversion between scales of temperature Heat &Temperature - Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation. **Mensuration** Area and perimeter of square, rectangle and parallelogram

		Area and perimeter of Triangles Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder **Trigonometry** Measurement of angles Trigonometrical ratios Trigonometrical tables
Project work / Industrial visit **Broad Area:** a) Welding and brazing b) Drawing plan c) Panel wiring with motor control d) Power electronic circuits and digital electronic components e) AC/DC drives		

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 90 Hrs; Professional Knowledge 23 Hrs	Carry out safe operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors. (Mapped NOS: PSS/N9428)	162. Demonstrate different types of elevators viz., Hydraulic, Pneumatic, Traction, etc. (12 hrs.) 163. Demonstrate different types of conveying equipment viz., Escalators, Belt conveyor, Bucket conveyor, etc. (12 hrs.) 164. Practice use of Personnel safety equipment viz., hard hat, Safety belt, cut resistance gloves, dust mask, ear plug, head lamp, etc. (10 hrs.) 165. Demonstrate different screws, nut-bolts, clamps, rivets and shackles used in lift and escalators. (10 hrs.) 166. Demonstrate emergency safety devices used in elevators. (8 hrs.) 167. Identify components of elevator. (8 hrs.) 168. Demonstrate working of elevator. (10 hrs.) 169. Demonstrate working of moving walkways. (8 hrs.)	Working principle of different elevators, types of conveying equipment. Importance of personnel safety in lifts and escalators. Applications and proper use of; Hard hat, Safety belt, lifeline, Barricade, Cut resistance gloves, goggles, dust musk, head lamp, ear plug, JHA, cardinal rules. Emergency equipment of the elevator; Emergency light, Automatic rescue device, door sensor, emergency alarm. Components of elevator; Types of elevator Capacity and speed of the Elevator. Moving walkways. (23 hrs)
Professional	Carry out	170. Practice Fixing of	Methods and procedure for

Skill 200 Hrs; Professional Knowledge 50 Hrs	installation of elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings. (Mapped NOS: PSS/N9429)	template. (07 hrs.) 171. Practice Fixing of bracket. (05 hrs.) 172. Practice Fixing of guide rail. (07 hrs.) 173. Demonstrate counter weight, buffer, car frame, emergency stop switch. (05 hrs.) 174. Demonstrate landing zone, top over travel. (7 hrs.) 175. Demonstrate over speed Governor, safety circuit, overhead clearance and car bottom clearance. (8 hrs.) 176. Demonstrate construction and parts of different elevators. (05 hrs.) 177. Demonstrate different types of elevator well/ pit. (05 hrs.) 178. Practice fixing of Guide rails, reed switch, magnet and observe running clearance. (07 hrs.) 179. Perform fixing of ropes/belt and limit switches. (07 hrs.) 180. Carry out inspection of car top. (07 hrs.) 181. Perform fixing and checking of electromagnet brake. (07 hrs.) 182. Fix cams and pulleys. (07	Template setting. Hoist way measurement, Bracket measurement & fixing. Guide rail hoisting & 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

		hrs.) 183. Demonstrate fixing of machine beam and beam support. (8 hrs.) 184. Demonstration fixing of spur gear, worm gear and Bearings. (5 hrs.) 185. Practice fixing of car components. (09 hrs.) 186. Practice fixing of car lighting and fan. (2 hrs.) 187. Fix and adjust compensation chain and governor tension weight. (8 hrs.) 188. Demonstrate and practice of installation of door. (8 hrs.) 189. Demonstrate and practice of installation of cage. (8 hrs.) 190. Practice fitting of rope. (8 hrs.) 191. Practice installation of travelling cable. (12 hrs.) 192. Demonstrate safe use of scaffolding. (5 hrs.) 193. Prepare check of list and report for commissioning. (5 hrs.) 194. Prepare documents for getting license. (2 hrs.) 195. Carry out testing of wiring circuit and motor before commissioning. (12 hrs.) 196. Perform inspection run and normal run. (6 hrs.) 197. Practice installation of	guard, retiring cam, limit cam and sheave used in lift. Process of fixing Machine beam and beam support. Dead end hitch, spur gear, worm gear and Bearings. Difference between Geared and Gearless machine. Components of Car Operating Panel. Hall fixture and lantern. Compensation chain, cage bulldog clip, governor tension weight and counter screen. Types of Doors and procedure of installation. Cage fitting, function of isolation. Concept and calculation of roping/ run by (1:1 , 2:1, 4:1) Procedure of travelling cable installation. Types scaffolding & their standards. Concept of scaffoldless installation system. Commissioning; Concept, Procedure/ steps. Procedure of getting elevator license and commissioning certificate. Procedure, Types of governor and pulley, types of Car gate, etc. Space required for the erection of lift of different capacity. Required car area according to No. of passengers.

		different types of ropes, guide, buffers, counter weight, etc. (10 hrs.) 198. Practice installation of governor and pulley. (08 hrs.) 199. Practice installation of car gate. (6 hrs.) 200. Calculate car area for different No. of passengers. (2 hrs.) 201. Calculate elevator speed for different applications. (4 hrs.) 202. Calculate capacity of elevator (Kg) as per No. of passengers. (2 hrs.)	Selection of elevator speed for various types of lift. Capacity of elevator; Selection of location of Lift Machine. Selection of rope, guide rail, buffers, counters weight etc. Systematic installation. (59 hrs)
Professional Skill 110 Hrs; Professional Knowledge 42 Hrs	Carry out installation of escalators and moving walkways in industries, shopping malls, subway stations and airport. (Mapped NOS: PSS/N9430)	203. Demonstrate different escalator arrangements. (08 hrs.) 204. Demonstrate moving walkways. (08 hrs.) 205. Practice calculation of boarding and alighting areas for different sizes and types of escalators. (12 hrs.) 206. Practice calculation of pit area and support requirements. (12 hrs.) 207. Demonstrate different parts of step and step chain assembly. (12 hrs.) 208. Demonstrate comb plate and hand rail parts. (12 hrs.) 209. Practice fixing of drive unit, drive chain and shaft. (17 hrs.)	Types of Escalator arrangements; parallel, multiple parallel, cross over. Typical applications Moving walkways and applications. Selection/ Calculation of - speed, step widths, inclination Boarding and alighting areas, Pits and supports Components/ Parts of escalators. Step parts and assemblies Step chain parts and assemblies, Comb plate parts Hand rails and related parts. Motors and brake assemblies, Drive unit, drive chain and shafts. Lubrication system and other miscellaneous parts.

		210. Practice fixing of different covers and panels. (17 hrs.) 211. Practice fixing of barriers and caution plates. (12 hrs.)	Covers, Decking, trim plates, panels, etc. Barriers, barrier assembly and caution plates. (42hrs)
Professional Skill 130 Hrs; Professional Knowledge 33 Hrs	Install various electrical and electronic control devices, safety devices, control panels, limit switches and power wiring, etc. for control drives of lifts and escalators. (Mapped NOS: PSS/N9431)	212. Demonstrate different control systems used in elevators. (07 hrs.) 213. Identify different components of control circuits. (8 hrs.) 214. Practice installation of various controls. (10 hrs.) 215. Practice fixing of different electrical equipment and controls. (10 hrs.) 216. Demonstrate the automatic levelling devices and their function with change of load. (07 hrs.) 217. Set parameters and practice various operations. (12 hrs.) 218. Practice manual and automatic push bottom operation. (10 hrs.) 219. Demonstrate auxiliary motor micro drive. (7 hrs.) 220. Demonstrate automatic levelling with main motor at various speeds. (7 hrs.) 221. Identify different alarming modes. (5 hrs.) 222. Practice reading of control circuit diagram.	Various control systems of lift and their utility. Rheostatic control and variable voltage control. Single speed, double speed and logic circuit control. Automatic levelling with change of load. Auxiliary motor micro drive. Electrical and control parts Automatic levelling with main motor at various speeds Automatic levelling devices. The floor selector type, hoist-way switching devices. Operation without mechanical contact. Manual operation, Push bottom, Automatic operation holds in push bottom operation, fully automatic push button operation, dual operation and signal operation. Alarming system Various electrical & electronic control circuits. Logic circuits used in lifts. Test and trial of mechanical, electrical and electronic system of lift. Procedure of testing with minimum to maximum level.

		(08 hrs.) 223. Inspect and check performance during test and trials. (8 hrs.) 224. Make records of observation during trials. (12 hrs.) 225. Practice alteration and adjustment as necessary. (7 hrs.) 226. Simulate common defects and practice of repair. (12 hrs.)	(33 hrs)
Professional Skill 185 Hrs; Professional Knowledge 50 Hrs	Carry out preventive & breakdown maintenance of lifts, escalators and moving walkways with due care and safety. (Mapped NOS: PSS/N9432)	227. Practice a good housekeeping while working in the lifts. (10 hrs.) 228. Practice of safe working in lifts. Follow electrical safety rules. (16 hrs.) 229. Demonstrate safety practices while working on live controller. (14 hrs.) 230. Demonstrate safety practices while working on top of the car & lift pit. (14 hrs.) 231. General awareness on public safety components and door safety. (10 hrs.) 232. Demonstrate use of personnel protective equipment. (13 hrs.) 233. Measure and adjust clearance between wall and car. (17 hrs.) 234. Measure and adjust	Safety of personnel, Safe use of hand & power tools. Proper method of hand lifting rigging and hoisting. Proper use of ladders and step Ladders. Clothing, safety shoes, safety glasses, Safety belt, hand-protective Cream, leather gloves. Hard hats, Safety net etc. Proper use of ladders step Ladders. Clothing, safety shoes, safety glasses, Safety belt, hand-protective Cream, leather gloves. Hard hats, Safety net etc. Size and shape of car Clearance and allowances between car and the wall. (30 hrs

		clearance between adjacent cars. (15 hrs.)	
		235. Check physical location of all components of lift as per drawing. (5 hrs.) 236. Practice repairing and replacement of different mechanical components. (17 hrs.) 237. Practice repairing and replacement of different electrical and electronic components. (17 hrs.) 238. Check physical location of all components of escalators and moving walkways as per drawing. (07 hrs.) 239. Carry out servicing of various mechanical and electrical parts of escalators and moving walkways as per drawing. (15 hrs.) 240. Practice draining out of old grease and oils. (5 hrs.) 241. Practice refilling of oil dashpots and grease cups. (5 hrs.) 182. Lubrication on car gate, cam bellows, buffer, rope, guiderail etc. (5 hrs.)	Concept of lift maintenance. Methods/ Types of maintenance. Preparing check list. Concept of maintenance schedule. Preparing and follow-up of maintenance schedule. Preventive maintenance, running maintenance and brake-down maintenance. Spare parts used for lift and escalators maintenance. Inventory/ stocking of spare parts. Preservation of spare parts. Types of lubricants, its properties and use in lifts. Importance of lubrication. Lubrication during installation and periodical lubrication. Disadvantage of improper lubrication. (20 hrs)
Professional Skill 125 Hrs; Professional Knowledge	Carry out various checks, testing, tuning of components, examine safety	242. Check lift's main supply, switches, fuses and contacts. (5 hrs.) 243. Examine & adjust all moving contacts of the	Effects of faulty power supply, i.e. single phasing, loose contact, improper voltage etc. Effect of wrong brush bedding

30 Hrs	devices and ensure proper functioning of lifts, escalators and moving walkways. (Mapped NOS: PSS/N9433)	controller. (5 hrs.) 244. Tightening connections and secure wires. (5 hrs.) 245. Check motor connections brush position, air gap, bearing etc. (5 hrs.) 246. Check brake shoe, magnetic coil, oil in magnet case, dash pot adjustment etc. (6 hrs.) 247. Check oil level at worm gear, replace oil if necessary. (4 hrs.) 248. Check shaft bearing, drum, drive sheave for excessive play & proper lubrication. (5 hrs.) 249. Careful examine safety governor for proper operating condition and lubrication. (5 hrs.) 250. Carefully examine all ropes for any damage and broken wire and proper lubrication. (5 hrs.) 251. Examine main & counter weights, guide rail for lubrication and efficient functioning of brackets and rail clips. (6 hrs.) 252. Check car shoes, buffers and its lubricants. (5 hrs.) 253. Carefully examine safety devices, tripping rod for its setting (set even). (5 hrs.) 254. Check levelling of car platform. (4 hrs.)	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). (30hrs)

		255. Check emergency opening of door and other emergency safety devices. (4 hrs.) 256. Check movement of travelling cables for foul. (6 hrs.) 257. Examine top and bottom final shaft way limit switches and other limit switches for their proper operation. (6 hrs.) 258. Renew contacts or replace limit switchesif required. (4 hrs.) 259. Examine safety plank switch under car platform. (4 hrs.) 260. Examine door contacts and gate contacts, adjusting and renewing parts where necessary. (4 hrs.) 261. Examine emergency cut out switches for door and gate contacts. (4 hrs.) 262. Examine light & fan switches and fixture in the car for proper operation. (4 hrs.) 263. Perform cleaning of top, bottom and inside car, lift pit, governor, machine, controller and other parts. (5 hrs.) 264. Check machine room for proper cleanliness. (4 hrs.)	

		265. Check proper functioning of relays, timers, signalling system, alarming system, indications, electrical interlocks etc. (6 hrs.) 266. Prepare servicing report and make records of operational state and recommendation if any. (4 hrs.) 267. Demonstrate Auto Rescue Device operating system and connection to lift System. (5 hrs.)	
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 Hrs	Read and apply engineering drawing for different application in the field of work. (Mapped NOS: PSS/N9401)	**ENGINEERING DRAWING:** Reading of Electrical Sign and Symbols. Sketches of Electrical components. Reading of Electrical wiring diagram and Layout diagram. Reading of Electrical earthing diagram. Drawing the schematic diagram of plate and pipe earthing. Drawing of Electrical circuit diagram. Drawing of Block diagram of Instruments & equipment of trades.	
Workshop Calculation & Science: 32 Hrs.			
Professional Knowledge WCS-32 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: PSS/N9402)	**WORKSHOP CALCULATION & SCIENCE:** **Friction** Friction - Lubrication **Algebra** Algebra - Addition, subtraction, multiplication & division Algebra - Theory of indices, algebraic formula, related problems **Elasticity** Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus **Profit and Loss** Profit and loss - Simple problems on profit & loss Profit and loss - Simple and compound interest	

		Estimation and Costing Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade. Estimation and costing - Problems on estimation and costing
Project work / Industrial visit **Broad Area:** a) Control system of lift/ escalators b) Safety devices c) Servicing report d) Prepare maintenance schedule		

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 hrs. + 60 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 / dgt.gov.in

ANNEXURE-I

List of Tools & Equipment			
LIFT AND ESCALATOR MECHANIC (For batch of 24Candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
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. SHOP TOOLS, INSTRUMENTS – For 2 (1+1) units no additional items are required			
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 2nd cut	12 Nos.
60.	File half round	200 mm 2nd cut	04 Nos.
61.	File round	200 mm 2nd 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.
C. General Machinery & Equipment			
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	Operate and test clinical equipment/ instruments used in hospital.	02 Nos.
E. Furniture & Accessories			
140.	Instructor's table		01 No.
141.	Instructor's chair		02 Nos.
142.	Working Bench	2.5 m x 1.20 m x 0.75 m	04 Nos.
143.	Metal Rack	100cm x 150cm x 45cm	04 Nos.
144.	Lockers with 16 drawers standard size		02 Nos.
145.	Almirah	2.5 m x 1.20 m x 0.5 m	01 No.
146.	Black board/white board		01 No.
147.	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.*

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


कौशलं बलम्