LIFT & ESCALATOR MECHANIC

NSQF LEVEL- 4.5

SECTOR - CAPITAL GOODS & MANUFACTURING

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

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

LIFT & ESCALATOR MECHANIC

(Engineering Trade)

SECTOR – CAPITAL GOODS AND MANUFACTURING

(Designed in 2024)

Version 2.1

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Developed By

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1. COURSE OVERVIEW

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

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

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

2. TRAINING SYSTEM

2.1 GENERAL

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

2.2 COURSE STRUCTURE

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

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

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

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

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

2.3 PROGRESSION PATHWAYS

- Can join as an Instructor in a Vocational Training Institute / technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

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

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS CRITERIA

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

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

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

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

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average in engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***good*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific

attributes of a trainer.	topic. • A ***high*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**LIFT & ESCALATOR MECHANIC - CITS**
Trade Code	DGT/4043
NCO – 2015	2356.0100, 7411.9900
NOS Covered	PSS/N9428, PSS/N9444, PSS/N9445, PSS/N9446, PSS/N9447, PSS/N9448, PSS/N9449, ASC/N9410, ASC/N9411
NSQF Level	Level-4.5
Duration of Craft Instructor Training	One Year
Unit Strength (No. of Student)	25
Entry Qualification	Degree in Electrical/ Electrical and Electronics Engineering from AICTE/ UGC recognized Engineering College/ University. OR 03 years Diploma in Electrical/ Electrical and Electronics Engineering after class 10th from AICTE/ recognized board of technical education. OR Ex-serviceman from Indian Armed forces with 15 years of service in related field as per equivalency through DGR. OR 10th Class with 02 year NTC/NAC passed in the trade of "Lift and Escalator Mechanic".
Minimum Age	16 years as on first day of academic session.
Space Norms	98.6 Sq. m
Power Norms	6 KW
Instructors Qualification for	
1. Lift & Escalator Mechanic - CITS Trade	B. Voc./ Degree in Electrical/ Electrical and Electronics Engineering from AICTE/UGC recognized engineering college/ university with two years' experience in relevant field. OR 03 years Diploma in Electrical/ Electrical and Electronics Engineering from AICTE/ recognized board of technical education with five years' experience in relevant field. OR Ex-serviceman from Indian Armed forces with 15 years of service in related filed as per equivalency through DGR. Candidate should have undergone methods of instruction course or minimum 02 years of experience in technical training institute of Indian armed forces. OR NTC/ NAC passed in the Lift and Escalator Mechanic trade with seven years' experience in relevant field. **Essential Qualification:**

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

4. JOB ROLE

Brief description of job roles:

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

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) 2356.0100 - Manual Training Teacher/ Craft Instructor
b) 7411.9900 - Building and Related Electricians, other

Reference NOS:

a) PSS/N9428
b) PSS/N9444
c) PSS/N9445
d) PSS/N9446
e) PSS/N9447
f) PSS/N9448
g) PSS/N9449
h) ASC/N9410
i) ASC/N9411

5. LEARNING OUTCOMES

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

5.1 TRADE TECHNOLOGY

1. Demonstrate operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors. (NOS: PSS/N9428)
2. Demonstrate to plan and install elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings. (NOS: PSS/N9444)
3. Demonstrate to plan and install escalators and moving walkways in industries, shopping malls, subway stations and airport. (NOS: PSS/N9445)
4. Demonstrate to plan and 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/N9446)
5. Examine and analyze preventive & breakdown maintenance of lifts, escalators and moving walkways. (NOS: PSS/N9447)
6. Monitor various checks, testing, tuning of components, examine safety devices and ensure proper functioning of lifts, escalators and moving walkways. (NOS: PSS/N9448)
7. Monitor processor based advanced lifts, hydraulic lifts, wireless controls and gearless mechanism. (NOS: PSS/N9449)
8. Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)
9. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: ASC/N9411)

6. COURSE CONTENT

SYLLABUS FOR LIFT & ESCALATOR MECHANIC (CITS) TRADE			
Duration	**Reference Learning Outcomes**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 40 Hrs; Professional Knowledge 20 Hrs	Demonstrate operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors.	1. Demonstrate different types of elevators viz., Hydraulic, Pneumatic, Traction, etc. 2. Demonstrate different types of conveying equipment viz., Escalators, Belt conveyor, Bucket conveyor, etc. 3. Practice use of Personnel safety equipment viz., hard hat, Safety belt, cut resistance gloves, dust mask, ear plug, head lamp, etc. 4. Demonstrate different screws, nut-bolts, clamps, rivets and shackles used in lift and escalators. 5. Demonstrate emergency safety devices used in elevators. 6. Demonstrate components of elevator. 7. Demonstrate working of elevator. 8. Demonstrate working of moving walkways.	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.
Professional Skill 130 Hrs; Professional Knowledge 50 Hrs	Demonstrate to plan and install elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings.	9. Fixing of template, bracket and guide rail. 10. Demonstrate counter weight, buffer, car frame, emergency stop switch. 11. Demonstrate landing zone, top over travel. 12. Demonstrate over speed Governor, safety circuit, overhead clearance and car bottom clearance.	Methods and procedure for 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.

		13. Construction and parts of different elevators. 14. Demonstrate different types of elevator well/ pit. 15. Fixing of Guide rails, reed switch, magnet and observe running clearance. 16. Fixing of ropes/belt and limit switches. 17. Carry out inspection of car top. 18. Fixing and checking of electromagnet brake. 19. Fixing of cams and pulleys. 20. Demonstrate fixing of machine beam and beam support. 21. Fixing of car components. 22. Fix and adjust compensation chain and governor tension weight. 23. Demonstrate installation of door. 24. Demonstrate installation of cage, travelling cable and rope. 25. Demonstrate safe use of scaffolding. 26. Prepare check of list and report for commissioning. 27. Prepare documents for getting license. 28. Testing of wiring circuit and motor before commissioning. 29. Perform inspection run and normal run. 30. Installation of different types of ropes, guide, buffers, counter weight, etc. 31. Installation of governor and pulley. 32. Installation of car gate.	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 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

		33. Calculate car area for different No. of passengers. 34. Calculate elevator speed for different applications. 35. Calculate capacity of elevator (Kg) as per No. of passengers.	standards. Concept of scaffold less installation system. Commissioning; Concept, Procedure/ steps. Types of governor and pulley, types of Car gate, etc. Space required for the erection of lift of different capacity. Capacity of elevator; Selection of location of Lift Machine. Selection of rope, guide rail, buffers, counters weight etc. Systematic installation.
Professional Skill 40 Hrs; Professional Knowledge 20 Hrs	Demonstrate to plan and install escalators and moving walkways in industries, shopping malls, subway stations and airport.	36. Demonstrate different escalator arrangements. 37. Demonstrate moving walkways. 38. Calculation of boarding and alighting areas for different sizes and types of escalators. 39. Calculation of pit area and support requirements. 40. Demonstrate different parts of step and step chain assembly. 41. Demonstrate comb plate and hand rail parts. 42. Fixing of drive unit, drive chain and shaft. 43. Fixing of different covers and panels. 44. Fixing of barriers and caution plates.	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. Covers, Decking, trim plates, panels, etc. Barriers, barrier assembly and caution plates.
Professional Skill 40 Hrs; Professional Knowledge 20 Hrs	Demonstrate to plan and Install various electrical and electronic control devices, safety devices, control panels, limit	45. Demonstrate different control systems and their components used in elevators. 46. Installation of various electrical equipment and control elements.	Various control systems of lift and their utility. Rheostatic control and variable voltage control. Single speed, double speed and logic circuit control. Automatic leveling with change

	switches and power wiring, etc. for control drives of lifts and escalators.	47. Demonstrate the automatic levelling devices and their function with change of load. 48. Set parameters and practice various operations. 49. Manual and automatic push bottom operation. 50. Demonstrate auxiliary motor micro drive. 51. Demonstrate automatic levelling with main motor at various speeds. 52. Demonstrate different alarming modes. 53. Reading of control circuit diagram. 54. Inspect, check performance during test/ trials and make records of observation. 55. Alteration and adjustment as necessary. 56. Simulate common defects and practice of repair.	of load. Auxiliary motor micro drive. Electrical and control parts Automatic leveling with main motor at various speeds Automatic leveling 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.
Professional Skill 80 Hrs; Professional Knowledge 40 Hrs	Examine and analyze preventive & breakdown maintenance of lifts, escalators and moving walkways.	57. Ensure good housekeeping and electrical safety rules while working in the lifts. 58. Safety practices while working on live controller. 59. Demonstrate safety practices while working on top of the car & lift pit. 60. Public safety components and door safety. 61. Demonstrate use of personnel protective equipment. 62. 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

		clearance between wall and car. 63. Measure and adjust clearance between adjacent cars. 64. Check physical location of all components of lift as per drawing. 65. Repairing and replacement of different mechanical components. 66. Repairing and replacement of different electrical and electronic components. 67. Check physical location of all components of escalators and moving walkways as per drawing. 68. Servicing of various mechanical and electrical parts of escalators and moving walkways as per manual. 69. Draining out and refilling of grease and oils. 70. Lubrication of car gate, cam bellows, buffer, rope, guiderail etc. 71. Maintain records of preventive and breakdown maintenance.	between car and the wall. 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.
Professional Skill 110 Hrs; Professional Knowledge 40 Hrs	Monitor various checks, testing, tuning of components, examine safety devices and ensure proper functioning of lifts, escalators and moving walkways.	72. Check lift's main supply, switches, fuses and contacts. 73. Examine & adjust all moving contacts of the controller. 74. Tightening connections and secure wires. 75. Check motor connections brush position, air gap, bearing etc. 76. Check brake shoe, magnetic coil, oil in magnet case, dash pot	Effects of faulty power supply, i.e. single phasing, loose contact, improper 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

		adjustment etc. 77. Check oil level at worm gear, replace oil if necessary. 78. Carefully examine all ropes for any damage and broken wire and proper lubrication. 79. Examine main & counter weights, guide rail for lubrication and efficient functioning of brackets and rail clips. 80. Check car shoes, buffers and its lubricants. 81. Check shaft bearing, drum, drive sheave for excessive play & proper lubrication. 82. Examine safety governor for proper operating condition and lubrication. 83. Carefully examine safety devices, tripping rod for its setting (set even). 84. Check levelling of car platform. 85. Check emergency opening of door and other emergency safety devices. 86. Check movement of travelling cables for foul. 87. Examine top and bottom final shaft way limit switches and other limit switches for their proper operation. 88. Renew contacts or replace limit switches if required. 89. Examine safety plank switch under car platform. 90. Examine door contacts	governor. Types of spring, function and use. Concept of wear and tear. System of leveling 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)

		and gate contacts, adjusting and renewing parts where necessary. 91. Examine emergency cut out switches for door and gate contacts. 92. Examine light & fan switches and fixture in the car for proper operation. 93. Ensure cleaning of top, bottom and inside car, lift pit, governor, machine, controller and other parts. 94. Check machine room for proper cleanliness. 95. Check proper functioning of relays, timers, signalling system, alarming system, indications, electrical interlocks etc. 96. Prepare servicing report and make records of operational state and recommendation if any. 97. Demonstrate Auto Rescue Device operating system and connection to lift System.	
Professional Skill 40 Hrs; Professional Knowledge 20 Hrs	Monitor processor based advanced lifts, hydraulic lifts, wireless controls and gearless mechanism.	98. Demonstrate microprocessor based control panel including VVVF controls. 99. Video demonstration of Hydraulic lift. 100. Demonstrate integrated control system. 101. Demonstrate wireless logic controls. 102. Demonstrate gearless machines. 103. Video demonstration of MRL (Machine room less lift).	Function of encoder Introduction of lift & Escalators Act (Latest) Lift & Escalators rules (Latest) Relevant Indian Standards (IS) of lift Lift & Escalator license procedure. Smart lift concept Solar lift concept Regenerative breaking.

Engineering Drawing: 30 Hrs.		
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different application in the field of work.	**CIRCLES, TANGENTS AND ELLIPSE:** Practical applications procedure for constructing tangent to given circle-lines- loop pattern-- tangential circles- external tangents- internal tangents ellipse **PARABOLIC CURVES, HYPERBOLA:** Involutes - Properties and their application. Procedure for constructing parabolic curve-hyperbolic curve-in volute curve. epicycloids, hypocycloid, Involutes, spiral & Archimedes spiral **TECHNICAL DRAWING/ SKETCHING OF COMPONENTS' PARTS:** Views of object Importance of technical sketching-types of sketches-Isometric drawing sketching- Oblique drawing sketching. **PROJECTIONS**: Theory of projections (Elaborate theoretical instructions), Reference planes, orthographic projections concept 1st Angle and 3rd Angle, Projections of points, Projections of Lines–determination of true lengths & inclinations. Projections of plane, determination of true shape. Exercises on missing surfaces and views. Orthographic drawing or interpretation of views. Introduction to first angle projections of solids. **ISOMETRIC VIEWS**: Fundamentals of isometric projections (Theoretical Projections) Isometric views from 2 to 3 given orthographic views. Preparation of simple working drawing of Furniture items like table, stool and any job prepared in the workshop. **SECTIONAL VIEWS:** Importance and salient features, Methods of representing sections, conventional sections of various materials, classification of sections, conventional in sectioning. Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, Rectangular, square angle, channel, rolled sections. Exercises on sectional views of different objects. - **DEVELOPMENT AND INTERSECTIONS:** Development of surfaces-Types of surface- Methods of development-Intersection-Methods of drawing intersection lines-critical point or key point. **FASTENERS**: Sketches of elements of screw threads, Sketches of studs, cap screws machine screws, set screws, Locking devices, bolts, Hexagonal & square nuts & nut bolt & washer assembly. Sketches of plain spring lock, toothed lock, washers, cap nut, check nut, slotted nut, cassel nut, sawn nut, wing nut, eye blot, tee bolt & foundation bolt. Sketches of various types of rivet heads (snap–pan–conical– countersunk) Sketches of keys (sunk, flat, saddle, gib head, woodruff) Sketches of hole & shaft assembly. **DETAIL DRAWING AND ASSEMBLY DRAWING:** Details of machine drawing- Assembly drawing- surface quality-surface finish

		standard- Method of indicating surface roughness for general engineering drawing-symbols used for indication of surface roughness-symbols for direction of lay. Geometrical tolerance. Detail drawing of the following with complete dimensioning, tolerances, material and Surface finish specifications 1. Universal couplings 2. Ball bearing and roller bearing. 3. Fast and loose pulley. 4. Stepped and V belt pulley. 5. Flanged Pipe joints, right angle bend. 6. Tool Post of Lathe Machine. 7. Tail Stock of Lathe Machine 8. Stepped and V belt pulley. 9. Flanged Pipe joints, right angle bend. 10. Tool Post of Lathe Machine. 11. Tail Stock of Lathe Machine Practice of blue print reading on limit, size, fits, tolerance, machining symbols, and reading out of assembly drawing etc., ISO Standards. **READING OF ENGINEERING DRAWING:** Blue print and machine drawing reading exercises. **GRAPHS & CHARTS**: Types (Bar, Pie, Percentage bar, Logarithmic), Preparation & interpretation of the graphs and charts. **AUTO CAD:** Familiarization with AutoCAD application in engineering drawing. Practice on AutoCAD using Draw & Modify commands. Practice on AutoCAD with Rectangular snap using Draw, Modify, Inquiry commands. Practice on AutoCAD using text dimensioning& dimensioning styles Practice on AutoCAD to draw nuts, bolts & washers. Isometric views-isometric views with square, taper and radial surface-simple & complex views. Perspective views. Practice on AutoCAD using isometric snap to make isometric drawings Practice on AutoCAD using Hatch command and application. Practice on AutoCAD using 3D primitives with UCS (User Co-ordinate system).
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.	**<u>WORKSHOP CALCULATION:</u>** **Fraction:** Concept of Fraction, Numbers, Variable, Constant, **Ratio & Proportion**: - Trade related problems **Percentage:** Definition, changing percentage to decimal and fraction and vice versa. Applied problems related to trade. Estimation and cost of product. **Algebra:** Fundamental Algebraic formulae for multiplication and factorization. Algebraic equations, simple & simultaneous equations, quadratic equations and their applications. **Mensuration 2D:** Concept on basic geometrical definitions, basic

		geometrical theorems. Determination of areas, perimeters of triangles, quadrilaterals, polygons, circle, sector etc. **Mensuration 3D:** Determination of volumes, surface areas of cube, cuboids cylinders, hollow cylinder, sphere prisms, pyramids cone spheres, frustums etc. Mass, Weight, Volume, Density, Viscosity, Specific gravity and related problems. **Trigonometry:** Concept of angles, measurement of angles in degrees, grades and radians and their conversions. Trigonometrical ratios and their relations. Review of ratios of some standard angles (0, 30,45,60,90 degrees), Height & Distances, Simple problems. **Graphs:** basic concept, importance. Plotting of graphs of simple linear equation. Related problems on ohm's law, series-parallel combination. **Statistics:** Frequency tables, normal distribution, measure of central tendency – Mean, Median & Mode. Concept of probability. Charts like pie chart, bar chart, line diagram, Histogram and frequency polygon. **WORKSHOP SCIENCE:** **Units and Dimensions:** Conversions between British & Metric system of Units. Fundamental and derived units in SI System, Dimensions of Physical Quantities (MLT)-Fundamental & Derived. **Engineering Materials:** Classification properties and uses of ferrous metals, non-ferrous metals, alloys etc. Properties and uses of non-metals such as wood, plastic, rubber, ceramics industrial adhesives. **Heat & Temperature:** Concepts, differences, effects of heat, different units, relation, specific heat, thermal capacity, latent heat, water equivalent, mechanical equivalent of heat. Different Temperature measuring scales and their relation. Transference of heat, conduction, convection and radiation. Thermal Expansion related calculations. **Force and Motion**: Newton's laws of motion, displacement, velocity, acceleration, retardation, rest & motion such as linear, angular. Force – units, different laws for composition and resolution of forces. Concept on centre of gravity and equilibrium of forces in plane. Concept of moment of inertia and torque. **Work, power & energy**:

		Definitions, units, calculation & application. Concept of HP, IHP, BHP and FHP – related calculations with mechanical efficiency. S.I. unit of power and their relations. **Friction:** Concept of friction, laws of friction, limiting friction, coefficient of friction and angle of friction. Rolling friction & sliding friction with examples. Friction on inclined surfaces **Stress & Strain:** Concepts of stress, strain, modulus of elasticity. Stress- strain curve. Hook's law, different module of elasticity like Young's modulus, modulus of rigidity, bulk modulus and their relations. Poisson's ratio. **Simple machines:** Concept of Mechanical Advantage, Velocity Ratio, Efficiency and their relations. Working principles of inclined plane, lever, screw jack, wheel and axle, differential wheel and axle, worm and worm wheel, rack and pinion. Gear train. **Electricity:** Basic definitions like emf, current, resistance, potential difference, etc. Uses of electricity. Difference between ac and dc. Safety devices. Difference between conductors and semiconductors and resistors, Materials used for conductors, semiconductors and resistors. Ohm's Law. Series, parallel and series-parallel combination of resistances. Concept, definitions and units of electrical work, power and energy with related problems. **Fluid Mechanics:** Properties of fluid (density, viscosity, specific weight, specific volume, specific gravity) with their units. Concept of atmospheric pressure, gauge pressure, absolute pressure, vacuum and differential pressure.

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

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

7. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Demonstrate operation of different types of lifts, escalators, moving walkways, belt conveyors and bucket conveyors. (NOS: PSS/N9428)	Demonstrate 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.
	Demonstrate components of elevator.
	Demonstrate working of elevator/ moving walkways.
2. Demonstrate to plan and install elevators in industries, shopping malls, subway stations, airport and multi storied residential buildings. (NOS: PSS/N9444)	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.
	Installation of 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/ capacity of elevator for different No. of passengers.
	Calculate elevator speed for different applications.
3. Demonstrate to plan and install escalators and moving walkways in industries, shopping malls, subway stations and airport. (NOS: PSS/N9445)	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.

4. Demonstrate to plan and 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/N9446)	Demonstrate different control systems used in elevators.
	Demonstrate automatic levelling devices and explain function.
	Demonstrate automatic levelling with main motor at various speeds.
	Demonstrate different alarming modes.
	Prepare list for checking performance during test and trials.
	Perform repair for common defects.
5. Examine and analyze preventive & breakdown maintenance of lifts, escalators and moving walkways. (NOS: PSS/N9447)	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.
	Record keeping of maintenance.
6. Monitor various checks, testing, tuning of components, examine safety devices and ensure proper functioning of lifts, escalators and moving walkways. (NOS: PSS/N9448)	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 leveling 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.
7. Monitor processor based advanced lifts, hydraulic lifts, wireless controls and gearless mechanism. (NOS: PSS/N9449)	Demonstrate microprocessor based control panel including VVVF controls.
	Fundamentals of Hydraulic lift.
	Integrated control system.
	Explain wireless logic controls.
	Fundamentals of gearless machines.
	Concept of MRL (Machine room less lift)/ smart lift/ solar lift
8. Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
9. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: ASC/N9411)	Solve different mathematical problems.
	Explain concept of basic science related to the field of study.

8. INFRASTRUCTURE

LIST OF TOOLS & EQUIPMENT			
LIFT AND ESCALATOR MECHANIC (CITS) (For batch of 25 Candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Steel Tape	5 m length	25+1 Nos.
2.	Plier Insulated	150 mm	25+1 Nos.
3.	Plier Side Cutting	150 mm	25+1 Nos.
4.	Screw Driver	100 mm	25+1 Nos.
5.	Screw Driver	150 mm	25+1 Nos.
6.	Electrician Connector, screw driver insulated handle thin stem	100 mm	25+1 Nos.
7.	Heavy Duty Screw Driver	200 mm	25+1 Nos.
8.	Electrician Screw Driver thin stem insulated handle	250 mm	25+1 Nos.
9.	Punch Centre	150 mm x 9 mm	25+1 Nos.
10.	Knife Double Bladed Electrician		25+1 Nos.
11.	Neon Tester		25+1 Nos.
12.	Steel Rule	300 mm	25+1 Nos.
13.	Hammer, cross peen with handle		25+1 Nos.
14.	Hammer, ball peen With handle		25+1 Nos.
15.	Gimlet	6 mm	25+1 Nos.
16.	Bradawl		25+1 Nos.
17.	Scriber (Knurled centre position)		25+1 Nos.
18.	Pincer	150 mm	25+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	01 No.
25.	Chisel Cold firmer	25 mm X 200 mm	02 Nos.
26.	Chisel	25 mm and 6 mm	02 Nos. each
27.	Portable Electric Drill Machine	6 mm	01 No.
28.	Pillar Electric Drill Machine	12 mm capacity	01 No.
29.	Allen Key		01 set
30.	Oil Can	0.12 ltr	01 No.
31.	Grease Gun		01 No
32.	Out Side Micrometer		02 Nos.
33.	Motorised Bench Grinder		01 No.
34.	Rawl plug tool and bit		02 set

35.	Pully Puller		02 Nos.
36.	Pipe vice		04 Nos.
37.	Scissors blade	150 mm	04 Nos.
38.	Crimping Tool		02 sets
39.	Wire stripper	20 cm	02 Nos.
40.	Chisel Cold flat	12 mm	02 Nos.
41.	Mallet hard wood	0.50 kg	04 Nos.
42.	Hammer Extractor type	0.40 kg	04 Nos.
43.	Hacksaw frame	200 mm 300 mm adjustable	02 Nos. each
44.	Try Square	150 mm blade	04 Nos.
45.	Outside and Inside Divider Calipers		02 Nos. each
46.	Pliers flat nose	150 mm	04 Nos.
47.	Pliers round nose	100 mm	04 Nos.
48.	Tweezers	100 mm	04 Nos.
49.	Snip Straight and Bent	150 mm	02 Nos. each
50.	D.E. Metric Spanner	6 to 32 mm	02 Nos.
51.	Drill hand brace		04 Nos.
52.	Drill S.S. Twist block	2 mm, 5 mm 6 mm set of 3	04 Set
53.	Plane, smoothing cutters	50 mm	02 Nos. each
54.	Gauge, wire imperial		02 Nos.
55.	Hand Vice	50 mm jaw	04 Nos.
56.	Table Vice	100 mm jaw	12 Nos.
57.	Pipe Cutter to cut pipes	upto 5 cm. dia	04 Nos.
58.	Pipe Cutter to cut pipes	above 5 cm dia	02 Nos.
59.	Stock and Die set	for 20 mm to 50 mm G.I.	01 set
60.	Pipe		As Required
61.	Stock and Dies conduit		01 No.
62.	Digital Multi Meter		06 Nos.
63.	Mini Drafter		12 Nos.
64.	Drawing Compass set		04 Nos.
65.	Dial gauge		02 Nos.
66.	Chain pulley block	2 ton	01 No.
67.	Shackle		02 Nos.
68.	Ceiling rope nylon/steel		50 mtr
69.	Slings	2 ton capacity	01 No.
70.	Elevator rope cutter	upto 32 mm	02 Nos.
71.	Elevator limit switches		04 Nos.
72.	Electric Hammer type drill machine 22mm capacity with all accessories	750W, 240V	01 No.
73.	Electric Hand grinding machine with 110 mm wheel diameter	750W, 240V	01 No.
74.	Electric hand blower	750 W, 240V	01 No.
75.	Rail alignment gauge		02 Nos.

76.	Working Plank	10 x 15 inch	04 Nos.
C. General Machinery & Equipment			
77.	Mini welding machine - (With connecting cable, electrode holder, earthing clamp, safety glass and safety gloves)	150A, 240V	01 No.
78.	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.
79.	DC compound motor with switch fuse unit, voltmeter, ammeter, field regulator, armature regulator and four point starter	2 KW, 220V	01 No.
80.	Single phase capacitor start induction motor with starting panel	1KW, 240V	01 No.
81.	Universal motor with starting panel	0.75 KW, 240V	01 No.
82.	Three phase Squirrel cage induction motor with DOL starting panel	3 KW, 415 V	01 No.
83.	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.
84.	Digital AC drive trainer	3 Phase, 2 KW	01 No.
85.	Servo motor Trainer	250 W, 220/110 V	01 No.
86.	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 Monitor (Min. 17 Inch. Licensed Operating System and Antivirus compatible with trade related software.	01 No.
87.	Working model of Escalator		01 No.
88.	Electromagnet break assembly		01 No.
89.	Over speed governor for passenger lift		01 No.
90.	Door simulator set (car door, landing door and door drive unit)		01 No.
91.	5/8 Passenger lift installed with all control and safety accessories		01 No.
D. Safety Equipment			
92.	Industrial safety hat		04 Nos.
93.	Industrial safety shoe	different size	04 Nos.

94.	Fall arrest personnel safety belt		04 Nos.
95.	Life line rope - nylon braided made from high tenacity multifilament yarn	13 mm dia.	04 Nos.
96.	Safety net 3 x 3 meter		02 Nos.
97.	Head lamp 3 W with battery		02 Nos.
98.	Fire Extinguisher	CO_2, 2 KG	02 Nos.
99.	Fire Buckets	With Stand	02 Nos.
E. Furniture & Accessories			
100.	Instructor's table		01 No.
101.	Instructor's chair		02 Nos.
102.	Working Bench	2.5 m x 1.20 m x 0.75 m	04 Nos.
103.	Metal Rack	100cm x 150cm x 45cm	04 Nos.
104.	Lockers with 16 drawers standard size		02 Nos.
105.	Almirah	2.5 m x 1.20 m x 0.5 m	01 No.
106.	Black board/white board		01 No.
107.	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"** are 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.*


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