

**SYLLABUS OF SEMESTER SYSTEM
FOR THE TRADE OF**

**LIFT AND ESCALATOR MECHANIC
(SEMESTER PATTERN)**

Under

**CRAFTSMAN TRAINING SCHEME (CTS)
(Two Year/Four Semesters)**

**Redesigned in
2014**

BY

**Government of India
Ministry of Labour & Employment
Directorate General of Employment & Training**

LIST TRADE EXPERTS, CORE GROUP MEMBERS & MENTOR COUNCIL MEMBERS

(S/Shri)

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6. K.L. Kuli Joint Director, CSTARI, Kolkatta
7. K. Srinivasa Rao Joint Director, CSTARI, Kolkatta
8. M. Thamizharasan Joint Director, CSTARI, Kolkatta
9. S. Mathivanan Dy Director, ATI, Chennai, (TEAM LEADER)
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22. C.M. Diggewadi Trg Officer, RDAT, Mumbai
23. A. Chakraborty Trg Officer, CSTARI, Kolkatta
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31. K. Amaresan ATO, Govt ITI, Guindy, Chennai
32. Dr.P. Mahanto Professor, IIT, Guwahati
33. K.K. Seth Ex. Director, BHEL, Noida
34. N. Chattopadhyay Sr. DGM, BHEL, Kolkatta
35. Surendu Adhikari OTIS Elevator Co. India Ltd, Kolkatta
36. K. Raju Consultant- Energy Area, ASCI, Hyderabad
37. Ravi G Deshmukh Certified Energy Auditor, PPS Energy solutions, Pune
38. R. Thiruppathi JTS, IIT, Madras, Chennai
39. M.N. Krishnamurthy Retd. Ex Engineer, TNEB, Chennai
40. S. Kirubanandam Asst. Ex Engineer, TANTRANSOCO, Chennai
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42. L.R. Sundarajan Jr. Works Manager, Heavy vehicles factory
43. B.S. Sudheendara Consultant, VI micro systems pvt ltd, Chennai.
44. S. Ganesh Manager, L&T , Chennai
45. G. Neethimani Vice principal, Rane engine valves ltd, Chennai.

GENERAL INFORMATION

1. Name of the trade: **Lift and Escalator Mechanic**
2. N.C.O. Code No. : 8333.70
3. Duration: Four Semesters each of six months duration (2 Years)
4. Entry Qualification: Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.
5. Unit Strength: 16
6. Space Norms:
 - a) Workshop: 98.6.0 Sq.mt.
 - b) Class room: 30.0 Sq.mt.
7. Power Norms: 6.0 KW
8. Instructor's Qualification:
 - a. Degree in Mechanical/Electrical/Electrical & Electronics Engg. from recognized engg. College/university with one year experience in the relevant field

OR

 - b. Diploma in Mechanical/Electrical/Electrical & Electronics Engg. from recognized board of technical education with two years experience in the relevant field

OR

 - c. NTC/NAC in the Trade of "Lift Mechanic/ Lift and Escalator Mechanic" With 3 years post qualification experience in the relevant field.

Course Information (Lift and Escalator Mechanic)

Introduction

- This course is meant for candidates who aspire to become a professional lift and escalator mechanic with installation and maintenance skills.
- This course is renamed and restructured as Lift and Escalator Mechanic from the existing CTS Lift Mechanic.

Terminal competencies/ Deliverables:-

After successful completion of this course the trainee shall be able to perform the following skills with proper sequence

1. Install service and maintain various types of elevators, escalators and moving walkways in industries, shopping malls, subway stations, airport, multi storied residential building and perform other related tasks.
2. Install various kinds of electrical and electronic control switches, safety devices, control panels, limit switches and power wiring for control drives.
3. Test / check and adjust, replace any defects in controllers, safety devices, wiring by using meggar, multimeter and related tools.
4. Measure electrical quantities using electrical meters, install, connect, start, run, reverse and stop DC and AC machines along with protective and controlling devices and maintain them.
5. Carry out industrial wiring as per BIS recommendation and IE rules.
6. Fabricate ,test and troubleshoot simple electronic circuit and wiring of controller, alarm, displays, sensors and PLC s

Employment Opportunities:

1. Install ,test, service and maintain various kinds of elevators, escalators and moving auto walks in shopping malls, industries, multistoried buildings in IT filed and residential buildings ,airport, hospitals, subways stations and railway stations.
2. Elevator, escalator and conveyor manufacturing industries.
3. Lift operator in hospitals and shopping malls.
4. Lift and escalator mechanic in public and private organizations.
5. Huge abroad job opportunities.

Further learning pathways:

- On successful completion of the course, they can pursue Apprenticeship training in the reputed industries / organizations.

Syllabus for the Trade of “Lift and Escalator Mechanic” Under CTS

Semester: First

Duration: Six Months

Week No.	Trade Practical	Trade Theory
1	<p>Implementation in the shop floor of the various safety measures.</p> <p>Visit to the different sections of the Institute.</p> <p>Demonstration on elementary first aid.</p> <p>Artificial Respiration</p> <p>Practice on use of fire extinguishers.</p>	<p>Occupational Safety and Health</p> <p>Basic safety introduction, Personal protection.</p> <p>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution and personal safety message.</p> <p>Use of Fire extinguishers.</p> <p>Visit and observation of sections.</p> <p>Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard.</p>
2	<p>Demonstration of Trade hand tools. Identification of simple types- screws, nuts & bolts, chassis, clamps, rivets etc.</p> <p>Use, care and maintenance of various hand tools.</p>	<p>Identification of Trade-Hand tools- Specifications, Uses and their care maintenance.</p>
3	<p>Practice in using cutting pliers, screw drivers, etc. skinning the cables and jointing practice on singlestrand and multi stranded conductor.</p> <p>Demonstration and Practice on bare conductors joints-- such as Britannia, straight, T, Western union Joints</p>	<p>Fundamental of electricity. Electron theory-free electron, Fundamental terms, definitions, units and effects of electric current</p> <p>Explanation, Definition and properties of conductors, insulators and semi-conductors- Wires/cable & its specification.</p> <p>Types of wire joints & uses.</p>
4	<p>Practice on soldering- Measurement of Resistance.</p> <p>Determination of specific Resistance.</p>	<p>Solders, flux and soldering technique.</p> <p>Types & properties of resistors</p> <p>Specific Resistance.</p>
5-6	<p>Verification of Ohm’s Law, Verification of Kirchoff’s Laws.</p> <p>Verification of laws of series, parallel and combination circuits.</p> <p>Verification of open circuit and closed circuit network.</p> <p>Measuring unknown resistance using different methods-</p> <p>a) Using Wheatstone Bridge</p> <p>b) By voltage drop method.</p>	<p>Ohm’s Law -</p> <p>Simple electrical circuits and problems.</p> <p>Resistors -Laws of Resistance.</p> <p>Series, parallel and combination circuits.</p> <p>Kirchoff’s Laws and applications. Wheatstone bridge principle and its applications.</p> <p>Effect of variation of temperature on resistance.</p> <p>Different methods of measuring the values of resistance.</p>

	Experiment to demonstrate the variation of resistance of a metal with the change in temperature.	
7	Demonstration and identification of types of cables. Demonstration and practice on using standard wire gauge & micrometre. Practice on crimping thimbles, Lugs.	Introduction of National Electrical Code Voltage grading of different types of Insulators, Temp. Rise permissible. Types of wires and cables standard wire gauge. Specification of wires and Cables- insulation and voltage grades- Low, medium and high voltage Precautions in using various types of cables / Ferrules
8	Identification and use of wiring accessories Practice on installation and overhauling common electrical accessories. Fixing of switches, holder plugs etc. in wooden/PVC/ Metallic boards.	Common Electrical wiring Accessories, their specifications in line with NEC - Explanation of switches, lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches, Use & specification of Fire alarm, MCB, ELCB, and MCCB.
9 - 11	Grouping of Dry cells for a specified voltage and current. Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries and Charging of batteries by different methods. Charging of a Lead acid cell, filling of electrolytes- Testing of charging .checking of discharged and fully charged battery. Care and maintenance of Batteries	Chemical effect of electric current- Principle of electrolysis. Faraday's Law of electrolysis. Basic principles of Electroplating and Electro chemical equivalents. 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, Cathode protection. Electroplating, Anodising. Different types of lead acid cells. Application of battery/cell in Inverter, 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. Care and maintenance of cells Grouping of cells of specified voltage and current, Sealed Maintenance free Batteries, Solar battery.
12-13	ALLIED TRADES: Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. Sawing and planning practice. Practice in using	Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels hacksaw frames and blades- their specification and grades. Care and maintenance of steel rule, try square and files. Marking tools description and use. Description of

	firmer chisel and preparing simple half lap joint.	carpenter's common hand tools such as saws planes, chisels, mallet, claw hammer, marking, dividing and holding tools-their care and maintenance.
14	Drilling practice in hand drilling and power drilling machines. Grinding practice Practice in using taps and dies, threading hexagonal and square nuts etc. cutting external threads on stud and on pipes, riveting practice.	Types of drills description and drilling machines, proper use, care and maintenance. Description of taps and dies, types of rivets and riveted joints. Use of thread gauge.
15	Practice in using snips, marking and cutting of straight and curved pieces in sheet metals. Bending the edges of sheet metals. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints.	Description of marking and cutting tools such as snips, shears, punches and other tools like hammers, mallets, etc. used by sheet metal workers. Different types of soldering materials, fluxes and process. Types of different soldering irons and their proper uses. Use of different bench tools used by sheet metal worker.
16-17	Trace the magnetic field. Assembly / winding of a simple electro magnet. Use of magnetic compass. Identification of different types of Capacitors. Charging and discharging of capacitor, Testing of Capacitors using DC voltage and lamp.	Magnetism - classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance. Para and Diamagnetism and Ferro magnetic 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 Induction, Faraday's Law, Lenz's Law. Electrostatics: Capacitor- Different types, functions and uses.
18-19	Determine the characteristics of RL, RC and RLC in A.C. Circuits both in series and parallel. Experiment on poly phase circuits. Current, voltage, power and power factor measurement in single & poly-phase circuits. Measurement of energy in single and poly-phase circuits. - Use of phase sequence meter.	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, P.F. etc. Concept three-phase Star and Delta

		connection. Line and phase voltage,current and power in a 3 phase circuits with balanced and unbalanced load.
20	Practice on Earthing - different methods of earthing. Measurement of Earth resistance by earth tester. Testing of Earth Leakage by ELCB and relay.	Earthing - Principle of different methods of earthing.i.e. Pipe, Plate etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB). In absence of latest revision in respective BIS provision for Earthing it is recommended to follow IEC guidelines.
21	Determine the resistance by Colour coding Identification of active/passive components. Diodes -symbol - Tests - Construct & Test Half wave rectifier ckt. Full wave rectifier ckt. Bridge rectifier ckt.	Basic electronics - Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter.
22-23	Industrial visit / project work	
24-25	NCVT EXAMINATION	
26	Semester Gap	

LIST OF TOOLS and EQUIPMENT

A. TRAINEES TOOL KIT FOR 16 TRAINEES +1 INSTRUCTOR

TOOL KIT			
Sl. No.	Name of the items	Quantity	Remarks
1	Steel Tape, 15 m length	17 Nos.	Sr. No. 1 to 18 tool kits to be Common for 1 to 4 semesters.
2	Plier Insulated, 150 mm	17 Nos.	
3	Plier Side Cutting, 150 mm	17 Nos.	
4	Screw Driver, 100 mm	17 Nos.	
5	Screw Driver, 150 mm	17 Nos.	
6	Electrician Connector, screw driver insulated handle thin stem, 100 mm	17 Nos.	
7	Heavy Duty Screw Driver , 200 mm	17 Nos.	
8	Electrician Screw Driver thin stem insulated handle, 250 mm	17 Nos.	
9	Punch Centre , 150 mm X 9 mm	17 Nos.	
10	Knife Double Bladed Electrician	17 Nos.	
11	Neon Tester	17 Nos.	
12	Steel Rule 300 mm	17 Nos.	
13	Hammer, cross peen with handle	17 Nos.	
14	Hammer, ball peen With handle	17 Nos.	
15	Gimlet 6 mm.	17 Nos.	
16	Bradawl	17 Nos.	
17	Scriber (Knurled centre position)	17 Nos.	
18	Pincer 150 mm	17 Nos.	
NOTE: For 2 nd Unit of the Trade, only Trainees Tool Kit (from Sl No- 1 to 18) is required additionally.			

B. Shop Tools, Instruments & Outfit

Sl. No.	Name of the items	Quantity	Required for Semester			
			I	II	III	IV
1	First aid box	01 set	Y	Y	Y	Y
2	C- Clamp 200 mm, 150 mm and 100 mm	2 Nos each	Y	Y	Y	
3	Spanner Adjustable 150 mm,300mm	2 Nos each	Y	Y	Y	Y
4	Blow lamp 0.5 ltr	1	Y	Y		
5	Melting Pot	1	Y	Y	Y	
6	Ladel	1No	Y	Y		
7	Chisel Cold firmer 25 mm X 200 mm	2	Y	Y	Y	Y
8	Chisel 25 mm and 6 mm	2 Nos each	Y	Y	Y	Y
9	Hand Drill Machine	1	Y	Y	Y	
10	Portable Electric Drill Machine 6 mm capacity	1	Y	Y	Y	
11	Pillar Electric Drill Machine 12 mm capacity	1	Y	Y	Y	Y
12	Allen Key	1 set	Y	Y	Y	Y
13	Oil Can 0.12 ltr	1	Y	Y	Y	Y
14	Grease Gun	1 No	Y	Y	Y	Y
15	Out Side Micrometer	2	Y		Y	
16	Motorised Bench Grinder	1	Y	Y	Y	Y
17	Rawl plug tool and bit	2 set	Y	Y	Y	
18	Pully Puller	2	Y	Y	Y	

19	Bearing Puller	2	Y	Y	Y	
20	Pipe vice	4	Y	Y	Y	
21	Thermometer 0 to 100 deg Centigrade	1 No.	Y			
22	Scissors blade 150 mm	4 Nos.	Y	Y	Y	
23	Crimping Tool	2 sets	Y	Y	Y	Y
24	Wire stripper 20 cm	2 Nos.	Y	Y	Y	Y
25	Chisel Cold flat 12 mm	2 Nos.	Y	Y	Y	Y
26	Mallet hard wood 0.50 kg	4 Nos.	Y	Y	Y	Y
27	Hammer Extractor type 0.40 kg	4 Nos.	Y	Y	Y	
28	Hacksaw frame 200 mm 300 mm adjustable	2 Nos. each	Y	Y	Y	Y
29	Try Square 150 mm blade	4 Nos.	Y	Y	Y	Y
30	Outside and Inside Divider Calliper	2 Nos. each	Y	Y	Y	
31	Pliers flat nose 150 mm	4 Nos.	Y	Y	Y	Y
32	Pliers round nose 100 mm	4 Nos.	Y	Y	Y	Y
33	Tweezers 100 mm	4 Nos.	Y	Y		
34	Snip Straight and Bent 150 mm	2 Nos. each	Y	Y	Y	
35	D.E. metric Spanner	2 Nos.	Y	Y	Y	Y
36	Drill hand brace	4 Nos.	Y	Y	Y	
37	Drill S.S. Twist block 2 mm, 5 mm 6 mm set of 3	4 Set	Y	Y	Y	Y
38	Plane, smoothing cutters 50 mm	2 Nos. each	Y			
39	Gauge, wire imperial	2 Nos.	Y	Y		
40	File flat 200 mm 2 nd cut	8 Nos.	Y	Y	Y	Y
41	File half round 200 mm 2 nd cut	4 Nos.	Y	Y	Y	Y
42	File round 200 mm 2 nd cut	4 Nos.	Y	Y	Y	Y
43	File flat 150 mm rough	4 Nos.	Y	Y	Y	Y
44	File flat 250 mm bastard	4 Nos.	Y	Y	Y	Y
45	File flat 250 mm smooth	4 Nos.	Y	Y	Y	Y
46	File Rasp, half round 200 mm bastard	4 Nos.	Y			
47	Soldering Iron 25 watt, 65 watt, 125 watt	2 Nos. each	Y	Y	Y	Y
48	Copper bit soldering iron 0.25 kg.	2 Nos.	Y	Y		
49	Desoldering Gun	4 Nos.	Y	Y	Y	Y
50	Hand Vice 50 mm jaw	4 Nos.	Y	Y	Y	Y
51	Table Vice 100 mm jaw	8 Nos.	Y	Y	Y	Y
52	Pipe Cutter to cut pipes upto 5 cm. dia	4 Nos.	Y	Y	Y	
53	Pipe Cutter to cut pipes above 5 cm dia	2 Nos.	Y	Y	Y	
54	Stock and Die set for 20 mm to 50 mm G.I. pipe	1 set	Y	Y	Y	
55	Stock and Dies conduit	1 No.	Y	Y	Y	
56	Ohm Meter; Series Type & Shunt Type	2 Nos. each	Y	Y		
57	Multi Meter (analog) 0 to 1000 M Ohms, 2.5 to 500 V	2 Nos.	Y	Y	Y	Y
58	Digital Multi Meter	6 Nos.	Y	Y	Y	Y
59	A.C. Voltmeter M.I. 0 -500V A.C	1 No.	Y	Y		
60	Milli Voltmeter centre zero 100 - 0 - 100 m volt	1 No.	Y	Y		
61	D.C. Milli ammeter 0 -500m A	1 No.	Y	Y		
62	Ammeter MC 0-5 A, 0- 25 A	1 No. each	Y	Y		
63	A.C. Ammeter M.I. 0-5A, 0-25 A	1 No. each	Y	Y		

64	Kilo Wattmeter 0-1-3 kw	1 No.	Y	Y		
65	A.C. Energy Meter, Single phase 5 amp. Three Phase 15 amp	1 No. each	Y	Y		
66	Power Factor Meter	1 No.	Y	Y		
67	Frequency Meter	1 No.	Y	Y		
68	Flux meter	1 No.	Y	Y		
69	Wheat Stone Bridge with galvanometer and battery	1 No.	Y			
70	Laboratory Type Induction Coil	1 No.	Y			
71	DC Power Supply 0-30V, 2 amp	1 No.	Y	Y	Y	
72	Rheostat 0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 1 Amp 0- 300 Ohm, 1 Amp	1 No. each	Y	Y		
73	1 Phase Variable Auto Transformer	1 No.	Y	Y		
74	Battery Charger	1 No.	Y			
75	Hydrometer	1 No.	Y			
76	Miniature Breaker 16 amp (Raw Material)	1 No.	Y			
77	Working Bench 2.5 m x 1.20 m x 0.75 m	4 Nos.	Y	Y	Y	Y
78	Fire Extinguisher CO ₂ , 2 KG	2 Nos.	Y	Y	Y	Y
79	Fire Buckets With Stand	2 Nos.	Y	Y	Y	Y

C: FURNITURE

<i>Sl. No.</i>	<i>Name of the items</i>	<i>Quantity</i>	<i>Remarks</i>
1	Instructor's table	1 No.	Common for 1 to 4 semesters
2	Instructor's chair	2 Nos.	
3	Metal Rack 100cm x 150cm x 45cm	4 Nos.	
4	Lockers with 16 drawers standard size	2 Nos.	
5	Almirah 2.5 m x 1.20 m x 0.5 m	1 No.	
6	Black board/white board	1 No.	

Syllabus for the Trade of “Lift and Escalator Mechanic” Under CTS

Semester: Second

Duration: Six Months

Week No.	Trade Practical	Trade Theory
1	Basic Civil/drafting Work <ul style="list-style-type: none"> • Drawing plan • Elevation of points, lines, surfaces, solids • Dimensioning techniques. 	Study of <ul style="list-style-type: none"> • Definition and types of projections. • Methods of projection as per IS. • Projection of points, lines, planes and solids. • Concept of brick well , RCC well
2	<ul style="list-style-type: none"> • Drawing different types of foundation • Footing, piles, grillages • Foundation raft & well foundation. • Demonstrate & use of spirit level, water level ,plumb bob 	<ul style="list-style-type: none"> • Foundation: Types, Purpose & causes of failure of foundation • Drawing of footing foundation, excavation, shoring& simple machine foundations.
3	Use of Lifting Tools and Simple Welding <ul style="list-style-type: none"> • Demonstrate & use of tape, dial gauge, scale, try square • Demonstrate & Practice of chain block, hoist, pulleys, shackle, ceiling etc 	<ul style="list-style-type: none"> • 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, permanent
4	<ul style="list-style-type: none"> • Practice of arc welding • Simple project job as per drawing 	<ul style="list-style-type: none"> • Process of welding, brazening • Concept of different types of welding • Types of electrode
5	Indian Electricity Rules <ul style="list-style-type: none"> • Preparation of check list for Do’s and Don’ts for operation and maintenance 	Study of <ul style="list-style-type: none"> • Indian Electricity rules pertaining to operation, construction and maintenance of Lifts and Escalators • Statutory provisions for getting license
6-7	Basic Panel wiring <ul style="list-style-type: none"> • Practice of wiring in control panel • Saddling, dressing and squiring of cables • Fixing and connection of thermostats, timers 	Study of <ul style="list-style-type: none"> • 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
8	<ul style="list-style-type: none"> • Mounting/ fixing of MCB, MCCB • Fixing Bus bars • Tapping connections from Bus bars 	<ul style="list-style-type: none"> • Specification & ratings of MCB, MCCB, ELCB, ACB • Bus bars size and spacing • Procedure for control panel erection
9	<ul style="list-style-type: none"> • Identification of different types of transformer • Connection of Control transformers. • Use of C.T. & P.T. • Connection of three phase transformer • Measure voltages at different tapings 	Study of <ul style="list-style-type: none"> • Single Phase Transformer • Types and Classification • Specification and simple problems on e.m.f. equation, turns ratio and efficiency

		<ul style="list-style-type: none"> • Three Phase Transformer • Types & Connections
10	<ul style="list-style-type: none"> • Basic Electrical motor: • Identify the parts of DC motors • Connection of DC motors • Running of DC motors at different speeds 	<ul style="list-style-type: none"> • Principle of DC Generation • Construction and types of DC motors • Starting & Speed control methods of DC motors
11	<ul style="list-style-type: none"> • Identify the parts AC generators • Practice voltage building up • Measure voltage and frequency 	<ul style="list-style-type: none"> • Principle of electromagnetic induction • Faraday's law, Lenz's law • Principle of AC Generation • Flemings Right Hand/Left Hand rule
12	AC MOTORS AND STARTING METHODS <ul style="list-style-type: none"> • Identify the parts AC motors • Connecting and Running different types of single phase motor • Testing of different types of single phase motor 	Study of <ul style="list-style-type: none"> • Working principle, construction of A.C. motors single phase motors, • Characteristics & testing single phase motors • Starting methods and applications
13	<ul style="list-style-type: none"> • Connecting and Testing of three phase induction motor • Running of three phase induction motor using different types starters – DOL, Soft Starter 	<ul style="list-style-type: none"> • Working principle, construction of A.C. motors three phase induction motors, • Characteristics & testing three phase induction motors • Starting methods and applications of poly phase induction motor.
14	<ul style="list-style-type: none"> • Change of direction of rotation • Connect and test different control elements as per drawing 	<ul style="list-style-type: none"> • Common Motor control circuit elements – start/stop push buttons, indicators, contactors, etc. • Simple drawings for starting and control circuit
15	<ul style="list-style-type: none"> • Identification of terminals and connection of synchronous motor. • Synchronous permanent magnet motor • Speed control 	<ul style="list-style-type: none"> • Construction and working principle of synchronous motor • Construction and working principle of synchronous permanent magnet motor • Size/rating of motor applicable for lift and escalator
16	AC/DC DRIVES <ul style="list-style-type: none"> • Identification of different parts of AC/DC drive • Identification of terminals of AC/DC drive 	Study of <ul style="list-style-type: none"> • Types of AC/DC drives • Functions and block diagram • Terminal connections – control and power
17	<ul style="list-style-type: none"> • Connection and operation of lift motor through VVVF drives • Speed control through drive • Practice connection and operation of lift motor through drive • Connection of A/D and D/A converters with drive 	<ul style="list-style-type: none"> • Applications of AC/DC drive • Basic parameter setting in variable voltage variable 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

18	Electronic Power Devices <ul style="list-style-type: none"> • Demonstration of simple Power control circuits by S.C.R & TRIAC, DIAC • Simple Characteristics of GTO 	<ul style="list-style-type: none"> • Types of electronic power devices • Working principle of SCR, DIAC & TRIAC • Working principle of GTO
19	<ul style="list-style-type: none"> • Demonstration of simple Power control circuits by UJT, FET, JFEET, MOSFET, IGBT • Identification of triggering circuits • Checking of inverter/UPS circuit 	<ul style="list-style-type: none"> • Working principle UJT, FET, JFEET, MOSFET, IGBT • Biasing and FET as amplifier and switch
20	<ul style="list-style-type: none"> • Practice on A/D and D/A converter • Identification of pins of different ICs • Check various registers, counters and timers 	<ul style="list-style-type: none"> • Analog to Digital converter • Digital to analog converter • Various types of ICs, buffer register, counters and timers • Digital memory types – ROM, RAM, EPROM
21	<ul style="list-style-type: none"> • Practice using simple circuits for Speed control of motor by thyristor • Run stepper/servo motor using electronic controller 	<ul style="list-style-type: none"> • Applications of power devices • Speed control of motor by thyristor • Concept of stepper/servo motor
22-23	Project Work/ Industrial Visit	
24-25	Revision and Examination	
26	Semester Gap	

A: Shop Tools, Instruments & Outfit:

Sl.No	Name of Item	Qty. (nos.)	Required for Semester			
			I	II	III	IV
1	Mini Drafter	8		Y		
2	Drawing Board with stand	8		Y		
3	French Curves set	4		Y		
4	Drawing Compass set	4		Y		
5	Diagonal scale	4		Y		
6	Dial gauge	2		Y	Y	
7	Chain pulley block 2 ton	1		Y	Y	Y
8	Shackle	2		Y	Y	
9	Ceiling rope nylon/steel	50 mtr		Y	Y	Y
10	Control transformer single phase 250 W With 12v, 24v, 48v, 110v and 240v tapping	1		Y	Y	
11	Single phase transformer 1 KVA with enclosure and input/output terminals	1		Y		
12	Current transformer 50/5, 20/5, 20/1 ampere	01 each		Y	Y	
13	Potential transformer 240/110, 415/110 volt	01 each		Y	Y	
14	Analog/Digital converter with four input/output	02		Y	Y	
15	Digital /Analog converter with four input/output	02		Y	Y	
16	Soft starter 3 phase, 415 V, 15 A	01		Y	Y	Y

B: Machinery & Equipment :

Sl.No	Name of Item	Qty				
1	Mini welding machine – 150A, 240V With connecting cable, electrode holder, earthing clamp, safety glass, safety gloves	01		Y	Y	Y
2	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		Y	Y	Y
3	DC compound motor 2 KW, 220V with switch fuse unit, voltmeter, ammeter, field regulator, armature regulator and four point starter	01		Y		
4	Single phase capacitor start induction motor with starting panel – 1KW, 240V	01		Y		
5	Universal motor with starting panel – 0.75 KW, 240V	01		Y		
6	Three phase Squirrel cage induction motor with DOL starting panel – 3 KW, 415 V	01		Y		
7	Synchronous permanent magnet motor with starting panel – 2 KW, 3 phase, 415 V (can be used as generator when coupled with DC compound motor)	01		Y	Y	
8	Digital AC drive trainer – 3 Phase, 2 KW	01		Y	Y	Y
9	Servo motor Trainer – 250 W, 220/110 V	01		Y	Y	Y
10	Desktop multimedia computer – i3/i5 processor, 2GB RAM, 500 GB HDD, 19.5" TFT monitor. With suitable UPS and computer table	01	Y	Y	Y	Y

Syllabus for the Trade of “Lift and Escalator Mechanic” Under CTS

Semester: Third

Duration: Six Months

Week No.	Trade Practical	Trade Theory
1-2	Personnel safety <ul style="list-style-type: none"> • Use of hard hat, Safety belt, Cut resistance gloves • Dust mask, Ear plug, Head lamp, 	Study of <ul style="list-style-type: none"> • Importance of personnel safety in lift • Applications and proper use of - Hard hat, Safety belt, lifeline , Baricade, Cut resistance gloves, goggles, dust musk, head lamp, ear plug, JHA, cardinal rules,
3	<ul style="list-style-type: none"> • Demonstrate the emergency safety devices 	<ul style="list-style-type: none"> • Emergency equipment of the elevator (Emergency light , Automatic rescue device ,door sensor , emergency alarm)
4	Operation of lift <ul style="list-style-type: none"> • Demonstrate the working of elevator • Components of elevator 	Study of <ul style="list-style-type: none"> • Components of elevator • Types of elevator • Capacity, speed of the elevator
5	<ul style="list-style-type: none"> • Practice Fixing of template • Practice Fixing of bracket • Practice Fixing of guide rail 	<ul style="list-style-type: none"> • Methods and procedure for Template setting • Hoist way measurement, Bracket measurement & fixing. • Guide rail hoisting & plumbing.
6	<ul style="list-style-type: none"> • Demonstrate counter weight, buffer, car frame , emergency stop switch • Demonstrate landing zone, top over travel 	<ul style="list-style-type: none"> • Concept of counter weight, buffer, car frame , emergency stop switch • Different types of door, landing zone, top over travel, head room,
7	<ul style="list-style-type: none"> • Demonstration of over speed Governor, safety circuit, overhead clearance, car bottom clearance 	<ul style="list-style-type: none"> • Elevator safety (over speed Governor, safety circuit, overhead clearance, car bottom clearance) • Common safety features of the elevator - ATT, overload, ISC, Fire, Earth quake
8	Type, construction and parts of lift <ul style="list-style-type: none"> • Demonstration of elevator types • Demonstration of types of elevator well/pit 	Study of <ul style="list-style-type: none"> • Types of elevator – passenger elevator ,service elevator, freight elevator • Concept of elevator well, elevator pit, pit depth
9	<ul style="list-style-type: none"> • Practice fixing Guide rails, reed switch, magnet • Observe running clearance 	<ul style="list-style-type: none"> • Types and procedure of fixing Guide rails, reed switch magnet • Importance of Running clearance
10	<ul style="list-style-type: none"> • Fixing of ropes/belt 	<ul style="list-style-type: none"> • Types of Ropes, Coated steel belt

	<ul style="list-style-type: none"> • Fixing of limit switches • Inspect car top • Fixing/checking of electromagnet brake 	<ul style="list-style-type: none"> • Types of limit switch and their application • Importance Car top Inspection • Electromagnetic brakes for lifts.
11	<ul style="list-style-type: none"> • Fixing of cams and pulleys • Demonstrate fixing of Machine beam and beam support • Demonstration/fixing of spur gear, worm gear and Bearings 	<ul style="list-style-type: none"> • 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 • Deadend hitch, spur gear, worm gear and Bearings • Difference between Geared and Gearless machine •
12	<ul style="list-style-type: none"> • Demonstrate fixing of car components • Fixing of car lighting and fan • Fixing/ adjustment of compensation chain, governor tension weight 	<ul style="list-style-type: none"> • Components of Car Operating Panel • Hall fixture and lantern • Compensation chain, cage bulldog clip, governor tension weight and counter screen,
13-14	<ul style="list-style-type: none"> • Demonstrate/practice installation of door • Demonstrate/practice installation of cage • Practice rope fitting 	<ul style="list-style-type: none"> • 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)
15	<ul style="list-style-type: none"> • Practice installation of travelling cable • Demonstrate safe use of scaffolding 	<ul style="list-style-type: none"> • Procedure of travelling cable installation. • Types scaffolding & their standards • Concept of scaffold less installation system
16	<ul style="list-style-type: none"> • Preparation of check list for commissioning and its report • Preparation of documents for licensing • Checking of wiring , motor, check list before start up • Inspection run and normal run 	<ul style="list-style-type: none"> • Concept of commissioning • Procedure/steps of commissioning • Procedure of getting elevator license and commissioning certificate
17	<p>Basic Construction and Parts of Escalators</p> <ul style="list-style-type: none"> • Demonstration of different escalator arrangements • Demonstration of moving walkways 	<p>Study of</p> <ul style="list-style-type: none"> • Types of Escalator arrangements – parallel, multiple parallel, cross over • Typical applications • Moving walkways and applications
18	<ul style="list-style-type: none"> • Practice calculation of boarding and alighting areas for different sizes and types of escalators • Practice calculation of pit area and support requirements 	<ul style="list-style-type: none"> • Selection/ Calculation of – speed, step widths, inclination • Boarding and alighting areas • Pits and supports
19	<ul style="list-style-type: none"> • Demonstration of different parts of step and step chain assembly 	<ul style="list-style-type: none"> • Components/Parts of escalators • Step parts and assemblies • Step chain parts and assemblies

20	<ul style="list-style-type: none"> • Demonstration of comb plate and hand rail parts • Demonstration/fixing of different control and electrical equipment • Demonstration/fixing of drive unit, drive chain and shaft 	<ul style="list-style-type: none"> • Comb plate parts • Hand rails and related parts • Electrical and control parts • Motors and brake assemblies • Drive unit, drive chain and shafts • Lubrication system and other miscellaneous parts
21	<ul style="list-style-type: none"> • Fixing Different covers and panels • Fixing barriers and caution plates 	<ul style="list-style-type: none"> • Covers, Decking, trim plates, panels, etc. • Barriers, barrier assembly and caution plates
22-23	Project Work/ Industrial Visit	
24-25	Revision and Examination	
26	Semester Gap	

A: Shop Tools, Instruments & Outfit

Sl.No	Name of Item	Qty	Required for Semester			
			I	II	III	IV
1	Industrial safety hat	04			Y	Y
2	Industrial safety shoe (different size)	04			Y	Y
3	Fall arrest personnel safety belt	04			Y	Y
4	Life line rope – nylon braided made from high tenacity multifilament yarn 13 mm dia.	04			Y	Y
5	Safety net 3 x 3 meter	02			Y	Y
6	Head lamp 3 W with battery	02			Y	Y
7	Slings 2 ton capacity	01			Y	Y
8	Elevator rope cutter upto 32mm	02			Y	Y
9	Elevator limit switches	04			Y	Y
10	Electric Hammer type drill machine 22mm capacity with all accessories - 750W, 240V	01			Y	Y
11	Electric Hand grinding machine with 110 mm wheel diameter – 750W, 240V	01			Y	Y
12	Electric hand blower – 750 W, 240V	01			Y	Y
13	Rail alignment gauge	02			Y	Y
14	Working Plank 10 x 15 inch	04			Y	Y

B: Machinery & Equipment :

Sl.No	Name of Item	Qty	Required for Semester			
			I	II	III	IV
1	Working model of Escalator	01			Y	Y
2	Electromagnet break assembly	01			Y	Y
3	Over speed governor for passenger lift	01			Y	Y
4	Door simulator set (car door, landing door and door drive unit)	01			Y	Y
5	5/8 Passenger lift installed with all control and safety accessories	01			Y	Y

Syllabus for the Trade of “Lift and Escalator Mechanic” Under CTS

Semester: Fourth

Duration: Six Months

Week No.	Trade Practical	Trade Theory
1	<p>FUNCTIONAL OPERATION OF LIFT</p> <ul style="list-style-type: none"> • Familiarization with different control system • Its installation and repair 	<p>Study of</p> <ul style="list-style-type: none"> • Various systems of control of lift and their utility • Rheostatic control and variable voltage control • Single speed, double speed, and logic circuit control.
2	<ul style="list-style-type: none"> • Understating the automatic levelling function • Practice and set various operations 	<ul style="list-style-type: none"> • Automatic levelling with change of load, Auxiliary motor micro drive • Automatic levelling with main motor at various speeds • Automatic levelling devices.
3	<ul style="list-style-type: none"> • Practice manual and automatic push bottom operation • Identify different alarming modes 	<ul style="list-style-type: none"> • The floor selector type, hoist-way switching devices • Operation without mechanical contact. Manual operation, Push bottom, • Automatic operation holds in push bottom operation, full automatic push button operation, dual operation and signal operation. • Alarming system
4	<ul style="list-style-type: none"> • Identification of different components of control circuits. • Tracing of control circuit diagram and necessary repair. 	<p>Study of</p> <ul style="list-style-type: none"> • Various electrical & electronic control circuits • Logic circuits used in lifts.
5	<ul style="list-style-type: none"> • Inspection of performance during Test & Trial. • Record of observation. 	<ul style="list-style-type: none"> • Test and trial of mechanical, electrical and electronic system of lift.
6	<ul style="list-style-type: none"> • Practice alteration and adjustment as necessary 	<ul style="list-style-type: none"> • Procedure of test with minimum and maximum level.
7	<p>SAFETY FUNCTIONS</p> <ul style="list-style-type: none"> • Housekeeping practice • Practice of safe working in lift - Electrical safety, Safety while working on live controller. • Safety while working on top of car & lift pit. 	<ul style="list-style-type: none"> • Safety of maintenance personnel - Safe use of hand & power tools. • Proper method of handling rigging and hoisting.

	<ul style="list-style-type: none"> • General awareness on public safety components. • Door safety. Demonstration of PPE 	<ul style="list-style-type: none"> • Proper use of ladders step Ladders. • Clothing, safety shoes, safety glasses, Safety belt, hand-protective Cream, leather gloves. Hard hats, Safety net etc.
8	SELECTION AND INSTALLATION OF LIFTS <ul style="list-style-type: none"> • Measure and adjust clearance between wall and car • Measure and adjust clearance between adjacent car 	Study of <ul style="list-style-type: none"> • Size and shape of car • Clearance and allowances between car and the wall. • Space required for the erection of lift of different capacity.
9	<ul style="list-style-type: none"> • Calculate car area for different no. of passengers • Calculate elevator speed for different applications 	<ul style="list-style-type: none"> • Required car area according to no. Of passenger. • Selection of elevator speed for various types of lift.
10	<ul style="list-style-type: none"> • Calculate capacity of elevator (Kg) as per no. of passengers • Installation of different types of ropes, guide, buffers, counter weight, etc. 	<ul style="list-style-type: none"> • Capacity of elevator • Selection of location of Lift Machine. • Selection of rope, guiderail, buffers, counterweight
11	<ul style="list-style-type: none"> • Installation of governor and pulley • Installation of car gate 	<ul style="list-style-type: none"> • Systematic installation procedure • Types of governor and pulley • Types of Car gate, etc.
12	MAINTENANCE PROCEDURE <ul style="list-style-type: none"> • Checking of physical location of all components of lift as per drawing 	<ul style="list-style-type: none"> • Concept of lift maintenance. • Methods / Types of maintenance. • Preparing check List.
13	<ul style="list-style-type: none"> • Practice repairing and replacement of different mechanical components. • Practice repairing and replacement of different electrical and electronic components 	<ul style="list-style-type: none"> • Concept of maintenance schedule. • Preparing and follow-up of maintenance schedule • Preventive maintenance, running maintenance and brake-down maintenance.
14	<ul style="list-style-type: none"> • Checking of physical location of all components of escalators and moving walkways as per drawing • Servicing of various mechanical/electrical parts of escalators and moving walkways as per drawing 	<ul style="list-style-type: none"> • Spare parts used for lift and escalators maintenance. • Inventory / stocking of spare parts. • Preservation of spare parts.
15	LUBRICATION <ul style="list-style-type: none"> • Practice draining out old grease and oils • Refilling oil dashpots and grease cups. • Lubrication on car gate, cam Bellows, buffer, rope, guiderail etc. 	<ul style="list-style-type: none"> • Types of lubricants, its properties and use in lifts. • Importance of lubrication. • Lubrication during installation and periodical lubrication. • Disadvantage of improper

		lubrication
16	<p>TESTING OF LIFT</p> <ul style="list-style-type: none"> • Servicing and checking of lift's main supply, switches, fuses and contacts. • Examine & adjust all moving contacts of the controller, • Tightening connections and secure wires. • Check motor connections brush position, air gap, bearing etc. 	<p>Study of</p> <ul style="list-style-type: none"> • Effects of faulty power supply, i.e. single phasing, loose contact, improper voltage etc. • Effect of wrong brush bedding and positioning
17	<ul style="list-style-type: none"> • Check brake shoe, magnetic coil, oil in magnet case, dash pot adjustment etc. • Check oil level at worm gear, replace oil if necessary. • Check shaft bearing, drum, drive sheave for excessive play & proper lubrication. 	<ul style="list-style-type: none"> • Effects faulty and loose braking system. • Different types of bearings used in lift. Their specification and properties.
18	<ul style="list-style-type: none"> • Careful examination of safety governor for proper operating condition and lubrication. • Carefully examine all ropes for any damage and broken wire and proper lubrication. • Examine main & counter weights, guide rail for lubrication and efficient functioning of brackets and rail clips. 	<ul style="list-style-type: none"> • Gear, worm and worm wheel used in lift and their function • Function of various parts of governor
19	<ul style="list-style-type: none"> • Check car shoes, buffers and its lubricants. • Carefully examine safety devices, tripping rod for its setting (set even) • Check levelling for car platform. • Check emergency opening of door and other emergency safety devices. • Check movement of travelling cables for foul. • Examine top and bottom final shaft way limit switches and other limit switches for their proper operation • Renew contacts or replace limit switches if required 	<ul style="list-style-type: none"> • Types of spring, function and use. • Concept of wear and tear. • System of levelling and alignment
20	<ul style="list-style-type: none"> • Examine safety plank switch under car platform • Examine door contacts and gate contacts, adjusting and renewing parts where necessary. • Examine emergency cut out switches for door and gate contacts. • Examine light & fan switches and fixture in the car for proper operation. • Cleaning of top, bottom and inside car, lift pit, governor, machine, controller and other parts. • Check machine room for proper cleanliness • Check proper functioning of relays, timers, signalling system, alarming system, indications, electrical interlocks etc. • Prepare servicing report. 	<ul style="list-style-type: none"> • 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

	• Record operational state and recommendation if any.	
21	• Familiarization with Auto Rescue Device operating system and connection to lift System	• Explanation and function of Auto rescue device (ARD)
22-23	Project Work/ Industrial Visit	
24-25	Revision and Examination	
26	Semester Gap	

NOTE:

1. **Tools Equipment and Machinery covered in previous three semesters will be sufficient to perform practical in fourth semester.**
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.