

Syllabus

For the trade of

MECHANIC AUTO ELECTRICAL & ELECTRONICS

Under CTS

2002

Designed by

Government of India

Ministry of Labour (D.G.E.&T.)

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

EN-Block, Sector – V, Salt Lake City,

Kolkata – 700091.

List of the Trade Committee Members approved the syllabus for the trade of “Mechanic Auto Electrical & Electronics” under CTS

1.	Shri H.Somasundram, Director	CSTARI, Kolkata	Chairman
2.	Shri C.R.Dey, Coordinator/Lecturer	George Telegraph Training Institute	Member
3.	Shri Tanmay Mitra, Territory Executive (Service)	MICO. Kolkata	Member
4.	Shri Ashim Kr. Banerjee, Proprietor	A.N.Motor, Kolkata,	Member
5.	Shri P.K.Das, V.I., (MMV)	A.T.I., Dasnagar	Member
6.	Shri Sanjay Kant, DDT.	CSTARI., Kolkata	Member
7.	Shri M.S.Ekambaram, ADT	CSTARI, Kolkata	Member
8.	Shri G. Nandi, Jr. D'man	CSTARI., Kolkata	Member

GENERAL INFORMATION

1. Name of the Trade : MECHANIC AUTO ELECTRICAL & ELECTRONICS
2. N.C.O. Code No. :
3. Duration of Craftsmen Training : 6 Months (26 weeks)
4. Entry Qualification : Passed 10th standard under 10 + 2 system with Science and Maths.
5. Unit size : 16 Trainees
6. Space requirement : 3.5 Sqm/Trainee.

SYLLABUS FOR THE TRADE OF “MECHANIC AUTO ELECTRICAL AND ELECTRONICS” UNDER C.T.S.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & science
1.	Familiarisation with Institute. Importance of the Trade Machinery used in trade. Types of work done by the students in the shop floor.	General introduction to the course – Duration of the course and course contents. Study of the syllabus. General rules pertaining to the Institute. Facilities available – hostel, recreation, medical and library – working hours – time table.	Free hand sketching of electrical symbols and drawing of simple electrical circuits.	Electricity and its effects of static and dynamic electricity. AC & DC differences.
2.	Description of safety equipment, their use, safety rules to be observed in Automobile repair shop. Accident their causes. Up keep of fire extinguishers. Familiarisation of the tools and machinery available in the shop – their use and up keep. Importance of cleanliness of work spot, tools, jacks, trays and horses etc.	Importance of safety and general precautions to be observed in the shop. Fire extinguishers used for different types of fire. Storing and handling of inflammable materials. Elementary First Aid.	-do-	
3.	Familiarisation on Automobile engines of diesel and petrol. Identification of automobile engine parts.	Introduction to automobiles. Basic working principles of I.C. engines, two stroke, four stroke engines. Difference between petrol engine and diesel engines. Single cylinder and Multi-cylinder engines. Study of transmissions, steering, brakes and body.	Freehand sketching of light circuit of a vehicle with electrical symbols. Sketching of various electronic devices used in motor vehicle.	Magnets – natural and artificial types, poles of magnets – magnetic field.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & science
4.	Practice in joining wires & soldering. Forming simple electrical circuit. Measuring of current, voltage and resistance.	Simple electrical circuits Identification of A.C. & D.C. meters. Insulators, conductors, Current rating of cables and wires	Free hand sketch of gauges and their circuit.	Calculation based on Ohm's Law.
5.	Construct circuits using 12 V, lamps and switches used in automobiles. Familiarise with the automobile cables and its ratings. Trace the light circuit - test bulbs, align head lamps, find out short and open circuits in the light wiring - replacing fuses testing the tail and brake lights in vehicle.	Ohm's Law and its application. Common electrical terms and symbols. Description of lighting circuit, fuses, their types and ratings. Incandescent lamps and halogen lamps, their differences, merits and demerits, colour coding of cables used in automobile wiring systems.	Free hand plotting of ignition circuit of a vehicle, sketching the circuit line diagram of magnetic ignition.	Definition of ampere, volt and Ohm's – units of current, voltage and resistance, Ohm's Law.
6.	Identifying and trace the circuits of different lighting circuit on different vehicles, trouble shooting of lighting circuits on two wheeler and four wheeler	Constructional details of headlamps, high beam and low beam dipper switches beam indicators, wiring circuits of headlights. Focussing of headlights, two-filament head lamp.		Advanced calculations relating to electric circuits.
7.	Measurement of voltage in cells and in batteries, connect the batteries in series and parallel and find their voltage and ampere-hour capacity. Testing of batteries using hydrometer, cell tester. Cleaning and topping up of a lead acid battery	Primary and secondary cells. Construction details and working of lead acid battery, chemical reaction during charging and discharging. Connection of cells, ampere-hour capacity. Indication of charged batteries. Use of hydrometer and cell tester.		Measurement of electrical power watt and kilowatt relationship with Horse Power.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & science
8.	Preparation of electrolyte, prepare battery for charging, study of battery charger, charge batteries in constant current, constant voltage methods. Trickle charging method.	Initial charging of battery, preparation of electrolyte, re-charging of batteries, charging procedure, constant voltage charging, constant current charging, boosted charging and slow rate charging, charging of sulphated batteries, over charging and its effects. Failure of batteries, maintenance of batteries. Maintenance free batteries. Effects of mishandling batteries on environment.	Battery Constructional Details	Problems on Charging current, ampere-hours, efficiency etc. Applied problems involving watt, kilowatt, volt-ampere and horsepower.
9 & 10	Removing alternator/dynamo in a vehicle, precautions while connecting battery in alternator circuit. General maintenance adjusting fan belt play tension. Study on construction of automobile alternator. Familiarise with the internal circuits of alternator. Testing of alternator starter winding and rotor winding. Overhauling and maintenance of alternators. Measurements voltage and current output and regulating voltage. Testing and replacing of various types of regulators	Description of charging circuit. Difference between dynamo and alternator, their operation common trouble and remedies. Ignition warning lamp. General details of automobile alternator, types of alternators, their internal circuits, care and maintenance of alternator. Advantage of alternator over DC generator. Regulators for alternators, construction and working of single unit regulator, two unit regulator, three unit regulator.	Free hand sketching of charging unit..	Applied problems on resistance in series and parallel circuits. Conductors and insulators – examples and uses. Measurement of electrical power watt and kilowatt relationship with horsepower conductors and insulator types and uses.

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & science
11 & 12	Removing starter motor from vehicle, overhauling and testing of starter motor. Study the bendix drive assembly. Assembling and dismantling of bendix drive mechanism and other commonly used drive mechanism. Dismantling and assembling of dynostat.	Description of starter motor circuit. Constructional details of starter motor. Construction and working principle of DC motor. DC series motor characteristics. Requirement of cranking motor. Dynostat its construction and working. Axial starter, pre-engaged starter and gear reduction starter	Sketching starter motor circuit and solenoid switch circuit. Free hand sketching of tracer plate assembly and advanced and retard plate.	Explanation of open and short circuits – locating short-circuits with the help of meters.
	Tracing of solenoid circuit, testing of solenoid switches and their replacement.	Solenoid switch common troubles and remedies in starter circuit.		-do-
13.	Identification of electronic control unit. Testing of electronic control circuit. Fault finding in electronic circuit and remedies.	Introduction to electronics. Definition of resistor, capacitor and inductor and their principles of working. Different types of diodes, transistors, power supply. Electric diesel control unit.		
14.	Removing an electrical horn from vehicle – dismantling, cleaning point, assembling the horn and adjusting the horn for correct sound, tuning double horn, repairing of horn relay and horn switches.	Electrical horn circuit, description of electric horn – operation of relay and horn switches. Common troubles and their remedies.	Free hand sketching of horn circuit, drawing the sectional view of horn	Sound and its units, permissible dB of important places.
15.	Removing a wiper motor – dismantling, cleaning, inspecting, repairing electrical wiper motors, assembling and fitting, setting blades for correct functioning.	Description and operation of an electric wiper motor, care and maintenance. Common troubles and remedies.	Free hand sketching of wiper motor circuit.	

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & science
16	Measurement of dwell angle using dwell tester. Functional check on ignition coil distributor at the installation. Familiarise with the distributors used in the multi-cylinder engines.	Magneto ignition system – description and operation, advantages – rotating armature and flywheel magnetos – special features.	Free hand sketching of magneto ignition circuit.	Concept of milli, micro and nano units
17 & 18	Tracing fault in different electronic ignition systems and rectification Removing, dismantling, cleaning and assembling magnetos adjusting gap in points – testing magnetos.	Principles of electronic ignition, advantages, types of electronic ignition system capacitor discharge ignition system, thyristor based ignition system and microprocessor based contactless ignition system. Adjustment of contact point gap measurement of dwell angle controlling of dwell angle spark advance mechanism, centrifugal advance mechanism and vacuum advance mechanism. Special ignition system such as surface discharge plug system, piezo electric ignition, and ring ignition, trouble shooting in ignition system.		
19	Measurement of spark gap by using feeler gauges in different types of plugs, adjust the spark gap with reference to manufacturer data cleaning checking and listing of spark plug using plugoscope. Adjustment of gap	MPFI system and its advantages. Description and functions of spark plugs their constructional details, types of spark plug, heat ranges of plugs. Fouling of spark plug, testing and adjusting of spark gap		

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & science
20	Dismantling and assembling of wiper motor, checking of wiper parts and year assembly. Overhauling and maintenance of wiper motor. Wiper motor with two speed and timer. Dismantling and cleaning contacts of horns and re-assembling of horns, tuning of horns, wind screen, wiper motor, link type permanent magnet wiper motor and door glass motor.	Constructional details of wiper motor, gear assembly, testing of wiper motor, electric horn their construction and working. Double horn systems. Wind screen wiper motor, wiper motor with two speed and timer link type permanent magnet wiper motor. Car fan assembly and fan motor, their construction and working, door glass motor.	Constructional details of wiper motor assembly.	Calculation of total current and power of electrical circuit of vehicle.
21	Trace the wiring circuit of traffic signal flashes light circuit – tracing defects in the flasher circuits, replacing fuse bulb. Trouble tracing in electrical wiring of the vehicle. Use of resistance meter voltmeter and ammeter. Attending mechanical repairs to electric accessories such as fuel gauge, temperature gauge, brake light switch, solenoids switch.	Flasher circuit, its description and operation, common troubles in the circuit and remedies. Layout of different sensors and indicating lamp in a vehicle. Fog lamp, side lamp, tail lamp, brake lamp their individual circuits and specifications study the combined wiring circuit diagram, flash light and sirens used in ambulance.	Free hand sketching of light circuit of vehicle with electrical symbols. Free hand sketching of the complete wiring of the vehicle.	
22	Checking instruments & gauges on dash board. Rectify/replace defective gauges. Study circuit diagram of anti theft device, checks repair and fit anti theft device on vehicle.	Different gauges used in automobiles, their function. Anti theft device function.		

Week No.	Practical	Theory	Engineering Drawing	Workshop Calculation & science
23	Familiarisation of car radio wiring and speaker circuits, Familiarise with the connection and operations of power window, electronic door locking systems, automatic rear view mirror, temperature indicators and electronic RPM indicators.	Car radio and cassette player, car videos, Construction and working details of power windows, electronic door locking systems, automatic rear view mirror, temperature indicators, automatic heaters and defrosters. Electronic RPM indicators. Antilock braking system, their working principles, construction and advantages. Study on electronic fuel injection system, function of fuel pump.		
24	Familiarise with MPFI system and ECM. Observe the various warning signals generated by the ECM and to attend the remedial measures.	Familiarise with the sensors used for MPFI system, Barometric pressure, Air Temp, Vacuum Pressure, Coolant Temp., Vehicle speed, Throttle position sensor, O ₂ sensor, Crank shaft angle sensor(CMP/CKP) and the functions of ECM. Care and maintenance of ECM.		
25	Entrepreneurship Training for self employment – concept of entrepreneurship finance to entrepreneurs. Incentives and subsidies.			
26	R e v i s i o n & T e s t			

LIST OF TOOLS AND EQUIPMENTS FOR THE TRADE OF “AUTO ELECTRICAL & ELECTRONICS”

Sl. No.	Description	Quantity
1	2	3

TOOL KIT

1.	Hammer Ball Peen 0.75 kg.	16
2.	Chisel Cold Flat 19 mm.	16
3.	Centre Punch 10mm dia x 100mm	16
4.	Steel rule 15 cm English and Metric	16
5.	Screw driver 30 cm x 9 mm blade	16
6.	Screw Driver 20 cm x 9 mm blade	16
7.	Spanner DE Set of 12 pieces (6 mm – 32 mm)	16
8.	Plier Combination 15 cm	16
9.	Hand file 20 cm second cut	16
10.	Feeler gauge 20 blades (metric)	16
11.	Ring Spanner set of 12 pieces (6 mm – 32 mm)	16
12.	Steel tool box with lock and key (folding type) size 400 x 200 x 150 mm.	16
13.	Allen key set of 12 pieces (2 mm – 14 mm)	4 sets
14.	Circlip Plier (External and internal) 150 mm. And 200 (two each)	8 sets
15.	Philips screw driver type set of 5 pieces 100 mm –300 mm.	4 sets
16.	Star Allen key	4 sets

TOOLS AND MEASURING INSTRUMENTS FOR GENERAL SHOP OUT FIT

1.	Rule Steel 300 mm	2
2.	Divider spring joint 150 mm	2
3.	Prick punch 15 cm	2
4.	Chisel cross cut 200 mm x 6 mm	1
5.	Hammer Ball Peen 0.5 kg.	2
6.	Engineering square 15 cm blade	2
7.	Hammer copper 1 kg. With handle	1
8.	Hack saw frame for 30 cm blade	4
9.	V-Block 75 x 38 mm pair with clamps	2
10.	Punch Hollow 6,7,8,9,10.5 and 12 mm set	1 set

11.	Hand Vice 37 mm	2
12.	Screw Driver, Electrician type 15 cm size	2
13.	File, flat 35 cm bastard	2
14.	File, flat 25 cm second cut	2
15.	Micrometer Outside 25 – 50 mm	1
16.	Micrometer Outside 0 – 25 mm	1
17.	Setting Hammer	1
18.	Mallet (wooden)	1
19.	Soldering iron 120 watts	2
20.	Pliers Nose (round and straight) 150 mm and 200 mm	2 each
21.	Drilling Machine (Bench) 12 mm dia.	1
22.	Distributor – old for practice	2
23.	Clip on Meter Digital and Analog	1 each
24.	Steel almirah 180 x 90 x 50 cm	1
25.	Fire extinguisher	2
26.	Fire buckets with stand	4
27.	Tachometer	1
28.	Tester sparking plug “NEON” Type	1
29.	Compressor air piston type (vehicular)	1
30.	High rate discharge tester	1
31.	Pneumatic tools	1 set
32.	General purpose puller	1 set
33.	Stud extractor	1 set
34.	Growler	1
35.	Battery charger	1
36.	Multimeter digital and analog	1 each
37.	Continuity meter	1
38.	Starter motor, alternator, dynamo cut out	2 each
39.	AC alternator slip ring puller	1
40.	AC alternator slip ring press tool	1
41.	Executive Auto Electrical Tool kit	1
42.	Distributor tester	1
43.	Electrical test bench	1
44.	Alternator regulator tester	1

45.	Car stereo	1
46.	Hydrometer	1
47.	Vehicle Euro 2	1
48.	Batteries 12V (lead acid)	2
49.	Electrical horn (different type)	4
50.	Viper motor assembly	4
51.	Engine Scanner	1
52.	Anti theft device	2