

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

Mechanic Auto Electrical & Electronics

Under

**Craftsmen Training Scheme (CTS)
(One year/Two Semesters)**

**Redesigned in
2014**

**By
Government of India
Ministry of Labour & Employment (DGE&T)**

GENERAL INFORMATION

1. Name of the Trade : **Mechanic Auto Electrical & Electronics**
2. N.C.O. Code No : **7241.70, 7242.10, ASC/ Q 1408**
3. Duration of Craftsmen Training : 1Year (Two Semester having duration of six months each)
4. Power Norms : 3 KW
5. Space Norms : Space Area 100 Sq. Mt. (Including parking area)
6. Entry Qualification : Passed 10th class examination with maths and Science
7. Unit strength : 16 + 30% super Numeric
8. Instructors Qualification :
a) Degree in Automobile/ Mechanical Engg./ Electrical /**Electronics & communication** Engg Engineering (with specialization in Automobile) from recognised college/ University with one year experience in the automobile industry and should possess valid LMV driving license
OR
Diploma in Automobile/Mechanical (specialization in automobile) / Electrical Engineering / **Electronics & communication** Engg from recognized board of technical education with two years experience in the automobile industry and should possess valid LMV driving license.
OR
10th Passed + NTC/NAC in the Trade of “**Mechanic Auto Electrical & Electronics**” with 3 years post qualification experience in the relevant field, and should possess valid LMV driving license.
and
b) With “**National Crafts Instructor Certificate**”.

- * **Note:**
- 1) At least one Instructor must have Degree/Diploma in Automobile/ Mechanical Engg/ Electrical Engineering / **Electronics & communication**. when applied for 02 units.
 - 2) Instructor Qualification for WCS & E.D, as per the Training Manual.

9. For Employability Skills One Contract/Part Time/Guest Faculty for Generic Module .
 i) MBA/ BBA with two years experience **OR** Graduate in Sociology / Social Welfare / Economics with Two years experience **OR** Graduate / Diploma with Two years experience and trained in Employability Skills from DGET institutes

AND

Must have studied English / Communication Skills and Basic Computer at 12th / Diploma level and above

OR

Existing Social Study Instructors duly trained in Employability Skills from DGET institutes

Distribution of training on Hourly basis:

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extra curricular activity
42 Hours	27 Hours	5 Hours	3 Hours	3 Hours	2 Hours	2 Hours

COURSE INFORMATION (MECHANIC AUTO ELECTRICAL AND ELECTRONICS)

1.Introduction :

- An intensive industrial survey was made to ascertain the requirements of skill-gap in the automobile sector, a scientifically designed survey covering labour-market survey web-survey was conducted. Based on the data obtained the skills are identified and accordingly the syllabus has been drafted. Subsequently the Trade expert committed reviewed.

2. Terminal Competencies/Deliverables :

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

- Installs, repairs replaces and overhauls wiring, starters, generators, distributors and other electrical equipment of motor vehicles.
- Examines vehicle battery, checks voltage and specific gravity using special equipment such as voltmeter hydrometer, heavy discharge tester, etc. and ensures that battery is in good condition.
- Checks vehicle wiring, locates faults and rectifies defects by replacing damaged wire or connecting ends with insulation tape.
- Starts engine to check whether alternator is charging correctly, and if distributor, condenser coil and cut out are functioning properly.
- Estimates nature of defects and reports components to be replaced or repaired.
- Dismantles and repairs electrical units and components such as generator, distributor etc. where required.

- Replaces repaired kit or unit in vehicle and connects it with battery.
- Conducts thorough examination of various electrical fittings such as lights, panel indicators, fuel pumps, etc and rectifies defects.
- Checks condition and makes necessary adjustments. May do armature winding. May drive vehicles on road. May charge batteries.
- Fits, assembles and repairs various kinds of electronic equipment in factory or workshop or at place of use.
- Examines drawings and wiring diagrams; checks parts for accuracy of fit and minor adjustments; assembles parts or mounts them on chassis or panels with aid of hand tools; Installs and connects wiring, soldering joints equipment, diagnoses faults with aid of electronic testing equipment;
- Dismantles equipment if required and replaces faulty parts or wiring.

3. Employment opportunities:

On successful completion of the course the candidates can either get employed, or become a self-employed Entrepreneur in any one of the following fields.

a) Wage Employment

1. Auto Electrician
2. Spare Parts Sales Assistant / Manufacturers' Representative
3. Laboratory Assistant
4. Diagnostic Mechanic
5. Car AC Mechanic

b) Self Employment

1. Diagnostic Mechanic
2. Spare Parts Salesman
3. Spare Parts Dealer

4. Further learning pathways:

- On successful completion of the course trainee can get themselves enrolled in Apprenticeship training in reputed Industrial organisation.
- The qualified candidates have scope for lateral entry into the Diploma courses offered by some of the State Governments
- The qualified candidates can also get themselves upgraded by taking up the Second Semester at his own convenience in the CTS scheme, since the first semester is common to the following trades.

Craftsman Training Scheme

- | | |
|---|--------------------|
| 1. Mechanic Motor Vehicle | - 2 Years (4 Sem) |
| 2. Mechanic Diesel | - 1 Year (2 Sem) |
| 3. Mechanic Motor Cycle | - 1 Year (2 Sem) |
| 4. Mechanic Auto Electrical and Electronics | - 1 Year (2 Sem) |
| 5. Mechanic Agricultural Machinery | - 2 Years (4 Sem) |
| 6. Mechanic Tractor | - 1 Year (2 Sem) |
| 7. Pump Operator cum Mechanic | - 1 Year (2 Sem) |

Syllabus for the trade of Mechanic Auto Electrical & Electronics
 First Semester (Semester code No.)
 Duration: Six Months.

Syllabus for Trade practical and Trade Theory

Week No.	Trade Practical (27 Hrs/week)	Trade Theory (5 Hrs/week)
1	Familiarisation with institute, Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor.	Admission & introduction to the trade: Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available– Hostel, Recreation, Medical and Library working hours and time table
2	Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. <i>Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of Used engine oil.</i> <i>Energy saving Tips of ITI electricity Usage</i>	Occupational Safety & Health Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles. Energy conservation -Definition, Energy Conservation Opportunities (ECOs)-Minor ECos and Medium ECos, Major ECos), Safety disposal of Used engine oil, Electrical safety tips.
3-5	Practice using all marking aids, like steel rule with spring calipers, dividers, scribe, punches, Chisel etc., Layout a work piece- for line, circle, arcs and circles. <i>Practice to measure a wheel base of a vehicle with measuring tape.</i> <i>Practice to measure valve spring tension using spring tension tester</i> <i>Practice to remove wheel lug nuts with use of an air impact wrench</i> Practice on General workshop tools & power tools.	Hand & Power Tools:- Marking scheme, Marking material-chalk, Prussian blue. Cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Calipers- inside and outside. Dividers, surface gauges, scribe, punches- prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer-ball peen, lump, mallet. Screw drivers- blade screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories, Pliers - Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers, external circlip pliers. Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing.

6&7	<p>Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers.</p> <p>Measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer.</p> <p>Measuring practice on valve spring free length.</p> <p>Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges.</p> <p>Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges.</p> <p>Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator.</p> <p>Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge.</p> <p>Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge.</p> <p>Practice to check engine manifold vacuum with vacuum gauge.</p> <p>Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting.</p>	<p>Systems of measurement, Description, care & use of - Micrometers- Outside and depth mirometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.</p>
8 & 9	<p>Practice on General cleaning, checking and use of nut, bolts, & studs etc.,</p> <p>Removal of stud/bolt from blind hole.</p> <p>Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding.</p> <p>Practice on Hacksawing and filing to given dimensions.</p>	<p>Fasteners- Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of Gaskets, Selection of materials for gaskets and packing, oil seals.</p> <p>Cutting tools :- Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.</p> <p>Limits, Fits & Tolerances:-Definition of limits,</p>

		fits & tolerances with examples used in auto components
10 & 11	Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. Practice on Tapping a Clear and Blind Hole, Selection of tap drill Size, use of Lubrication, Use of stud extractor. Cutting Threads on a Bolt/ Stud. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.	Drilling machine - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits. Taps and Dies: Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors. Hand Reamers – Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
12	Practice on making Rectangular Tray. Pipe bending, Fitting nipples unions in pipes. Soldering and Brazing of Pipes.	Sheet metal - State the various common metal Sheets used in Sheet Metal shop Sheet metal operations - Shearing, bending, Drawing, Squeezing Sheet metal joints - Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings.
13	Practice in joining wires using soldering Iron, Construction of simple electrical circuits, Measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers.	Basic electricity, Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Multimeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings
14	Diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, use of service manual wiring diagram for troubleshooting.	Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.
15	Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit.	Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermistors, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.

16	Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality , Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches.	Basic electronics: Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches.
17& 18	Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding. Setting of Gas welding flames, practice to make a straight beads and joints Oxy – Acetylene welding Film on Heat treatment process	Introduction to welding and Heat Treatment Welding processes – Principles of Arc welding, brief description, classification and applications. Manual Metal Arc welding -principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques; Oxy – Acetylene welding - principles, equipment, welding parameters, edge preparation & fit up and welding techniques; Heat Treatment Process– Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples.
19 & 20	Practice on Liquid penetrant testing method and Magnetic particle testing method. Identification of Hydraulic and pneumatic components used in vehicle. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. Identification of components in Air brake systems.	Non-destructive Testing Methods- Importance of Non-Destructive Testing In Automotive Industry, Definition of NDT , Liquid penetrant and Magnetic particle testing method – Portable Yoke method Introduction to Hydraulics & Pneumatics: - Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator).
21	Identification of different type of Vehicle. Demonstration of vehicle specification data; Identification of vehicle information Number (VIN). Demonstration of Garage, Service station equipments.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.	Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association. Definition: - Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and

		load. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.
22-23	In-plant Training	
24-25	Revision and Test	
26	NCVT Exam	

Automobile Group – 1 year Trade
1st Semster
Workshop Calculation and Science
Syllabus for the trade of Mechanic Auto Electrical & Electronics

Week No.	Workshop calculation and Science (3 Hrs/week)
1	Units, Derived and fundamental, types of system FPS, CGS, MKS and their conversion. Metric weights and measurements, units conversion factors
2	Fractions- Addition and subtraction, Fractions and whole numbers, Combined addition and subtraction, Multiplication and division of fractions. Operations in problems involving fractions.
3	Order of performing (BODMAS) Mathematical operators , Integers – Rules for dealing with integers, Addition, subtraction, Multiplication and division.
4 & 5	Ratio and proportion. Percentages, Examples of ratios in Automotive technology
6	profit and loss, Discount .
7	simple interest and compound interest
8	depreciation calculation
9-10	Time and work problem , Time and distance, clocks and calendar,
11	Brief description of manufacturing process of steel, and aluminum
12	Meaning of elasticity, malleability, brittleness, hardness, compressibility & ductility and their examples , Properties and uses of cast iron, ferrous metal, gray cast iron, white cast iron, wrought iron, and plain carbon steel, high speed steel and alloy steel.
13	Properties and uses in automobile industries- copper, zinc, lead, tin, aluminum, brass, bronze, solder bearing metals, timber and rubber. Nylon, P.V.C., PP (poly prop line, polymer).
14-15	Materials – Stress, strain,- Definition of Stress, Types of stress- Tensile, compressive, shear , Examples of the three basic stresses in automotive components , calculation of stress and strain in automotive application, Stress raisers, Strain-, Tensile, compressive, Shear strain, Tensile strength, Factor of safety, Torsional stress, Strain energy.
16	Definition of cold working and Hot working and its properties on sheet metal. Advantage of Deep drawing material. Importance of Iron- carbon diagram in heat treatment process.
17	Different Type of cutting fluids and their properties. Calculation of cutting speed, feed and drilling time.
18-19	Forces – Definition of Force, Types of force -examples,- Direct forces, Attractive forces, Explosive forces, Describing forces, Graphical representation of a force, Addition of forces, Parallelogram of forces ,Triangle of forces, Resolution of forces, Mass, Equilibrium, Pressure, Pressure in hydraulic systems, Hooke’s law, Practical applications.
20-21	Work energy, power– Definition and calculation of Work, Power and Work done by a torque, Definition and calculation of Energy -Potential energy, Chemical energy, Conservation of energy, Energy equation, Kinetic energy, Energy of a falling body, Kinetic energy of rotation.

Automobile Group – 1 year Trade
1st Semster- Engineering Drawing
Syllabus for the trade of Mechanic Auto Electrical & Electronics

Week No.	<u>Engineering Drawing (3 Hrs/week)</u> 1st Semester
1	Importance of engineering drawing as a communication medium, different types of drawing - Machine Drawing, Production Drawing, Part Drawing, Assembly Drawing, Drawing instruments, equipment and materials and their uses
2&3	Scales - Recommended scales, reduced & enlarged Drawing Sheet sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheet, sizes of title block and its contents. Using drawing instruments to draw straight lines, rectangles, squares, circles, polygons.
4&5	Lettering and Dimensioning - Types of Lettering, Guide Lines for lettering, Recommended sizes of letters and numbers, Single stroke letters, Dimensioning - rules and systems of dimensioning – dimensioning a given drawing.
6&7	Identify the alphabet of lines- Read and Interpret the meaning of various line types with examples- Object Lines, Hidden Lines, Center Lines, Phantom Lines, Dimension Lines, Extension Lines, Leaders, Break Lines -Long-break Line, Round, Solid, Hollow Cross Section, Section Lines – Common Manufacturing Materials, Cutting Plane Lines
8-11	Geometric Construction - Bisecting a line - perpendiculars - parallel lines - division of a line; Angles - bisection, trisection, Tangent lines touching circles internally and externally Polygons - Regular polygons - circumscribed and inscribed in circles. Conic sections - Definitions of focus, directrix, eccentricity, Construction of Ellipse by Concentric circles method, Construction of parabola by rectangular method.
12&13	Orthographic Projection - Definition - Planes of Projection - Four quadrants – Reference Line, First angle projection - Third angle projection.
14-17	Isometric Projection - Definition - Isometric axes, lines and planes, Isometric Scale - Isometric view. Drawing of isometric views of plane figures, Drawing of isometric views of prisms and pyramids, Drawing of isometric view of cylinders and cones
18-21	Development of Surfaces - Need for preparing development of surface, Concept of true length - Principal methods of development, Development of simple solids like cubes, prisms, cylinders, pyramids, cones.

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SYLLABUS FOR EMPLOYABILITY SKILLS

SEMESTER-I

(pl ref to www.dget.nic.in)

Syllabus for the trade of Mechanic Auto Electrical & Electronics

Second Semester (Semester code No.)

Duration: Six Months.

Syllabus for Trade practical and Trade Theory

Week No	Trade Practical (27 Hrs/week)	Trade Theory (5 Hrs/week)
1	<p>Identification of parts in a diesel engine of LMV/ HMV Practice on starting and stopping of diesel engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.</p>	<p>Introduction to Engine: Principle & working of 4-stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), difference between C.I engine and S.I Engine, Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light. Different type of starting and stopping method of Petrol/Diesel Engine</p>
2	<p>Practice to identify components and their locations indicated on the wiring diagram.</p> <p>Practice to identify the power source, ground connection, and controls for electrical circuits using a wiring diagram.</p>	<p>Electrical and Electronic Components:- Switches- Description of Normally open, Normally closed, single pole single throw switch (SPST), ganged, and mercury switches used in Automobile circuit. Description of Relay, ISO Relays, Solenoids, Buzzers. Resistors- Description of different type of resistors and their colour codes.- Fixed, stepped, and variable resistors-Rheostat, Potentiometer. Description of Diodes, Diode identification and ratings, zener diodes, Avalanche diodes, Light emitting diodes, photo diodes and clamping diodes. Transistors- Description of NPN, PNP, field-effect transistor (FET), phototransistors. Description of Integrated circuits. Circuit protection devices- Description of fuses, different type of fuses- glass or ceramic, blade and bullet or cartridge fuses. Fusible links, maxi fuses, circuit breaker, Positive Temperature coefficient (PTC) resistor device</p>

3	<p>Diagnosis and remedy for- Speedometer shows no operation, fuel level meter shows no operation, coolant temp meter shows no operation, Oil pressure light shows no lighting.</p>	<p>Wiring and circuit diagrams- Automotive Wiring- difference between primary wiring and secondary wiring. Comparison between solid and stranded primary wire.</p> <p>Description of wire size- Metric and American wire gauge (AWG), Importance of ground straps used in automotive wiring.</p> <p>Description of different type of terminals and connectors- Molded, multiple-wire hard shell, bulkhead, weather-pack, metri-pack, heat-shrink covered butt connectors.</p> <p>Importance of printed circuit boards, wiring harnesses, wiring diagrams and color codes and circuit numbering.</p> <p>Study of common electrical and electronic symbols used in wiring diagrams.</p>
4 & 5	<p>Check and replace ignition coil, overhauling Distributor Assembly.</p> <p>Checking ignition timing, Checking & changing a spark plug, Removing & replacing contact points</p> <p>Diagnosis- Possible causes and remedy for Engine cranks, but will not or hard to start, Poor fuel economy or engine performance.</p> <p>Identification and testing of Hall effect sensor, Optical sensor. Tracing and testing of sensor circuits.</p> <p>Tracing of Distributor less ignition systems circuit.</p>	<p>Ignition principles and Faraday's laws, Primary and secondary winding of transformer, Ignition components, Spark plugs, Spark plug components, Vacuum & centrifugal units, Plug firing voltage, Contact breaker system, ballast resistor coil, Dwell angle, Spark timing. Battery power source, Description and function of Capacitor/condenser, Distributors, Distributor types, High-tension leads, Advance & retard mechanisms.</p> <p>Principle of Induction –Mutual induction, self Induction, Inductive system operation, Induction wiring, Hall effect sensors, Hall effect operation, Optical type sensors Distributor less ignition systems, Insulated coils, Distributor less ignition system timing</p>
6 & 7	<p>Removing starter motor from vehicle, and Performance test for pull-in test, Hold-in test, pinion (plunger) return test, No-load performance test.</p> <p>Solenoid test for Hold in coil open circuit, Armature test – Ground test, Open circuit test, pull-in coil open circuit test, field coil test. Inspections of brush length wear as per service manual.</p> <p>Trouble shooting , possible causes and remedy for starter motor not running, Starting motor running but too slow (small torque), starting motor running, but not cranking engine. Noise, starting motor does not stop running.</p> <p>Growler testing for rotors.</p> <p>Checking a starting system, Jump-</p>	<p>Starting system- purpose of starting system, Starting system components, Starter motor principles, study of starter control circuits. Starter motor construction, Starter magnet types, Starter motor engagement, Commutation, Switching, solenoid construction..</p>

	starting a vehicle	
8 & 9	<p>Checking a charging system for the cause of undercharge, No charge, and over charge conditions. Removing & replacing an alternator, Inspection of rotor for ground, open circuit – field coil resistance, slip ring surface, Fan, bearing. Inspection of stator for ground, open circuit, Inspection of Drive end bearing rotation, Rectifier, brush length compare with service manual. slip ring surface. Inspecting & adjusting an engine drive belt, Replacing an engine drive belt / pulleys / Tesnionsers and their alignments.</p> <p>Trouble shooting, possible causes and remedy for warning lamp does not glow when ignition switch is on, Warning lamp glows dim when ignition switch is on, warning lamp ‘on’ while the alternator is running, Warning lamp glows ‘dim’ while the alternator is running, warning lamp flickers considerably.</p>	<p>Charging system- The purpose of Charging system, charging system components, charging system circuit, Alternator principles, Alternating current, Alternator components, Rectification, Phase winding connections, Rotor circuit, Voltage regulation, System operating voltage, High voltage charging systems, Rotor, Stator, Alternator end frames, Slip ring & brush assembly, Rectifier assembly, Alternator cooling fan.</p>
10 - 12	<p>Identification of EDC components, sensors, Testing of sensors and actuators.</p> <p>Identification of various components of MPFI system. Testing of MPFI components and replacement if necessary. Check delivery from fuel Pump. Replacing a fuel filter.</p> <p>Identification of Electronic control Unit. Set up for testing, Testing of Electronic Control Circuit. Fault finding in Electronic circuit and remedies using scan tool.</p>	<p>Electronic Diesel control- Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.</p> <p>Introduction to Electronic fuel injection (EFI) fuel supply system, Multi-point injection systems (MPI/MPFI), EFI air cleaners, Electronic mufflers, EFI fuel supply system components- Description of Fuel pumps, EFI sensors, Potentiometer, Auxiliary air valves, Idle speed control devices, Inertia sensors.</p> <p>Introduction to EFI Engine Management - EFI operation Modes of EFI, Idle speed control systems, Feedback & looping, Cold start systems, Air measurement, Air-flow monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram,</p> <p>Electronic control unit – ECU, EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp. Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes.</p>

13	<p>Identification of various sensors installed in engine & its mounting. Testing of Temperature sensor, Pressure sensor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor.</p>	<p>EFI sensors- Description, location and function of Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor.</p>
14 & 15	<p>Inspection of power steering control module circuit. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system. Trouble shooting and remedy for steering wheel feels heavy at low speed, poor recovery from turns, Vehicle pulls to one side during straight driving. Identification of ABS components, checking of ABS warning lamp. Identification of Automatic transmission components. Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler.</p>	<p>Steering, suspension and Brakes:- Description of Electric power assisted steering, Basic electric power steering operation, Electronic adjustable-rate shock absorbers, Electric brakes, Electro hydraulic braking (EHB), ABS brake system, Antilock braking system operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with Electronic Brake force Distribution (EBD) control unit. Electronic control transmission -Electronic control Unit, Fully hydraulically controlled transmission, Electronic shift programs, Manual selection</p>
16 & 17	<p>Identification of Air conditioning components, Performance test on A/c unit, Checking Charged state of refrigerant, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt. Checking a heating system, Compressor rotation test, air Gap check, Refrigerant recovery –evacuating – charging of A/c system. Replenishing compressor oil level Trouble diagnose and remedy for No cooling or warm air, Cool air comes out only intermittently, cool air comes out only at high, Insufficient cooling, Abnormal noise from compressor, Magnetic clutch, condenser, evaporator, Blower motor. Diagnosis test for High pressure gauge –pressure high and low, Low pressure gauge for pressure high and low.</p>	<p>Heating Ventilation Air Conditioning (HVAC) legislation, Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity, Description and function of Fixed orifice, Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air-conditioning compressors, Condensers & evaporators, Receiver drier, Lines & hoses, TX valve construction, Temperature monitoring thermostat, Refrigerants, Pressure switches, Heating elements. Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems.</p>
18 & 19	<p>Trace the light circuit - test bulbs, align head lamps, Aiming headlights. Changing a headlight bulb, Checking of a head light switch and to replace if faulty. Trouble shooting and remedy for</p>	<p>Lighting system, Lamps/light bulbs, Lamp/light bulb information, LED lighting, Headlights-description of standard sealed beam, halogen sealed beam, composite and High intensity discharge (HID) headlights. Headlight & dimmer circuits, Park & tail light</p>

	<p>Headlight - headlight do not light up, only one headlight does not light up, Only one beam (“Hi” or “Lo”) does not light..</p> <p>Trouble shooting and remedy for turn signal and hazard warning lights -Flash rate high or one side only flashes, No Flashing, flash rate low.</p> <p>Trouble shooting and remedy for clearance, tail and license plate lights - All lights do not light up, some lights do not light up.</p> <p>Trouble shooting and remedy for Back-up light - Back-up lights do not light up.</p> <p>Trouble shooting and remedy for Brake lights -Brake lights do not light up, Brake light stay on.</p> <p>Trouble shooting and remedy for fuel meter and fuel gauge unit - Fuel meter shows no operation or incorrect operation.</p> <p>Trouble shooting and remedy for Engine coolant Temp (ECT) meter and ECT Sensor – Engine coolant temp meter shows no operation or incorrect operation.</p> <p>Trouble shooting and remedy for oil pressure light – Oil pressure warning light does not light up when ignition switch is on at engine off.</p> <p>Trouble shooting and remedy for brake and parking brake warning light- Brake warning light does not light up when fluid flow level, Brake warning light does not light up when parking brake pull up, Brake warning lights stay on.</p> <p>Trouble shooting and remedy for interior light- Interior light do not light up.</p> <p>Trace the wiring circuit of traffic signal flashers light circuit-tracing defects in the flasher circuits, replacing fuse bulb.</p>	<p>circuits, Brake light circuits, turn signal circuit, Cornering lights, Fog lights circuit, interior lights- courtesy, reading and instrument panel lights, Smart lighting , Reverse lights.</p>
20 & 21	<p>Trouble shooting and remedy for Horn-No horn operation, poor sound quality, horn sounds continuously and to replace the horn if faulty.</p> <p>Remove and install wiper motors and wiper switches. Checking & replacing wiper blades.</p> <p>Trouble shooting and remedy for</p>	<p>Accessories: Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door lock circuit, remote keyless entry system circuit, antitheft system, immobilizer system. Navigation system, Car radio and cassette player, car videos.</p> <p>Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt</p>

	<p>windshield wiper and washer - no operation, intermittent operation, continuous operation, and wipers will not park.</p> <p>Diagnose causes for improper operation of the windshield washer system and to replace the pump if faulty.</p> <p>Diagnose the power window system for – all power window motors do not operate, some switches do not operate.</p> <p>Diagnose the power door lock control for – All power door locks do not operate, only one power door lock not operate.</p> <p>Diagnose for remote keyless entry and immobilizer system.</p> <p>Familiarization of car radio wiring and speaker circuits</p> <p>Diagnose automatic seat belt systems, Diagnose air bag system and service warnings.</p>	<p>pre-tensioners, Tire pressure monitoring systems</p> <p>Integrated communications, Proximity sensors, Reflective displays, Global positioning satellites, Triangulation/trilateration, Telematics. Application of Automotive bus system- currently used in cars: CAN (Control Area Network) , LIN (Local Interconnect Network), FlexRay™ and MOST(Media Oriented Systems Transport).</p> <p>, Importance of E/E Architecture</p>
22-23	Industrial Training /Project	
24-25	Revision and Test	
26	NCVT Exam	

Automobile Group – 1 year Trade
2nd Semster
Workshop Calculation and Science
Syllabus for the trade of Mechanic Auto Electrical & Electronics

Week No.	Workshop calculation and Science (3 Hrs/week)
1 & 2	Factorisation and quadratics: multiply expressions in brackets by a number, symbol or by another expression in a bracket; by extraction of a common factor eg $ax + ay$, $a(x + 2) + b(x + 2)$; by grouping eg $ax - ay + bx - by$; quadratic expressions eg $a^2 + 2ab + b^2$; roots of an equation eg quadratic equations with real roots by factorisation, and by the use of formula
3	Geometry – Use of scientific calculator,/logarithmic table Angles -Angular measurement, Angles and rotation, Examples of angles in automotive work, Adding and subtracting angles. Types of angle- Adjacent angles, Opposite angles, Corresponding angles, Alternate angle
4-6	Trigonometry- Types of triangle - Acute angled triangle, Obtuse angled triangle, Equilateral triangle, Isosceles triangle, Scalene triangle, Right angled triangle, Labelling sides and angles of a triangle, Sum of the three angles of a triangle. Pythagoras' theorem, Circles, Ratio of diameter and circumference, Length of arc, Timing marks, Wheel revolutions and distance travelled, Valve opening area. Trigonometry- Using sines, cosines and tangents to solve vehicle problems.
7 -10	Formulae for Perimeter and Area of Plane figure - Rectangle, Square, Parallelogram, Triangle, Hexagon, any regular polygon, Trapezium, Circle, sector, Fillet, Ellipse, segment of a circle; Formulae for Volume and surface area of solids- Rectangular solid, Prism, cylinder, pyramids and cones, Frustum of pyramid and cones, sphere, Hollow sphere, segment of sphere, circular ring, spherical sector, Calculation of volume and weight of simple solid bodies such as cubes, square and hexagonal prism-shop problem.
11-13	Statistics – Collecting and sorting raw data, Definition of Discrete variable, continuous variable with Shop examples. Constructing pictographs-pie chart, Bar chart. Frequency and tally Charts. Importance of the shape of a frequency distribution- histogram, frequency polygon, Cumulative frequency plot. Interpreting statistics- sampling, arithmetic mean, median,
14 & 15	Heat and temperature –Temperature-Thermodynamic temperature scale (Kelvin), Cooling system temperature; Standard temperature and pressure (STP); Thermal expansion with calculation; Heat- Sensible heat, Latent heat, Specific latent heat, Specific heat capacity, Quantity of heat with calculation; Heat transfer – Conduction, Convection, Radiation ;
16 & 17	Heating, expansion and compression of gases - Absolute pressure, Absolute temperature; Laws relating to the compression and expansion of gases -Heating a gas at constant volume, Heating a gas at constant pressure, Charles' law. Expansion or compression at constant temperature – isothermal

18-20	<p>Internal combustion engines- Engine power-Brake power, Horsepower, PS – the DIN, Indicated power, Mean effective pressure, Calculation of indicated power, Cylinder pressure vs. crank angle, Mechanical efficiency of an engine, Volumetric efficiency, Torque vs. engine speed, Specific fuel consumption vs. engine speed, Brake power, torque and sfc(Specific fuel consumption) compared, Brake mean effective pressure, Thermal efficiency, Indicated thermal efficiency, Brake thermal efficiency petrol vs. Diesel.</p>
21	<p>Fuels and combustion- Calorific value, Combustion-Products of combustion, Relevant combustion equations. Air–fuel ratio-Petrol engine combustion, Detonation, Pre-ignition, Octane rating, Diesel fuel, Flash point , Pour point, Cloud point, Biofuels, Liquefied petroleum gas (LPG) ,Hydrogen, Zero emissions vehicles (ZEVs)</p>

Automobile Group –
2nd Semester
Engineering Drawing
Syllabus for the trade of Mechanic Auto Electrical & Electronics

Week Nos.	<u>Engineering Drawing (3 Hrs/week)</u> 2nd Semester
1-4	Read and interpret drawings- Determine information from the title block, Read and interpret industrial prints, Read and interpret detailed and assembly drawings, Identify casting drawings and machining drawings, Read and interpret diagrams, Distinguish between a monodetail and a multidetail drawing.
5-8	Identify different drawing projections - Interpret pictorial and multi-view drawings. Interpret auxiliary and section views, Determine views in a drawing and the significance of the view being shown. Identify missing lines and missing views.
9-12	Free hand sketching of key and screw threads. Read and interpret three Types of screw thread representation: pictorial, schematic and simplified presentation. Terms used in describing a threaded Part, Designation of Thread Specifications, Left-Hand Thread Notations, read and interpret the different type of Finish Symbols, Fillets and Rounds and Machine Slots:-
13	Make a simple sketch in plan view of a front engine FWD vehicle. Label the main components: engine, clutch, gearbox, drive shafts, driving, wheels, radiator, fuel tank.
14	Free hand Sketching of Fuel supply High Pressure system. Control unit ingoing/outgoing information diagram.
15	Drawing of schematic diagram of ABS hydraulic circuit/Engine control module assembly
16	Free hand sketch of Torque converter Lay out for gearbox, Selector positions, Planetary gear set, High range power flow, Low range power flow
17	Block diagram of MPFI system. Sketching of various Electronic devices used in motor vehicle.
18	Free hand sketching of sensors. Free hand cut sectional view of petrol nozzle.
19	Sketching of Exploded view of alternator.
20	Sketching of Exploded view of starter motor.
21	Sketching of Air conditioning system using an expansion valve and orifice tube.

SYLLABUS FOR EMPLOYABILITY SKILLS

SEMESTER-II

(Pl ref to www.dget.nic.in)

TRADE: MECHANIC AUTO ELECTRICAL & ELECTRONICS

LIST OF TOOLS & EQUIPMNT

A. TRAINEES TOOL KIT per 4 Trainees FOR 20 TRAINEES +1 ISTRUCTOR

Sl.No.	Item with specification	Qty (Nos.)
1.	Allen Key set of 12 pieces (2mm to 14mm)	(5+1)
2.	Back probe tools	6
3.	Caliper inside 15 cm Spring	6
4.	Calipers outside 15 cm spring	6
5.	Center Punch 10 mm. Dia. x 100 mm.	6
6.	Dividers 15 cm Spring	6
7.	Electrician Screw Driver 250mm	6
8.	Hammer ball peen 0.5 kg with handle	6
9.	Hands file 20 cm. Second cut flat	6
10.	Logic probe	6
11.	Pliers combination 20 cm.	6
12.	Screw driver 20cm.X 9mm. Blade	6
13.	Screw driver 30 cm. X 9 mm. Blade	6
14.	Scriber 15 cm	6
15.	Spanner D.E. set of 12 pieces (6mm to 32mm)	6
16.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	6
17.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	6
18.	Steel rule 30 cm inch and metric	6
19.	Steel tool box with lock and key (folding type) 400x200x150 mm	6
20.	Test light	6
21.	Wire cutter and stripper	6

B. Tools Instruments and General Shop outfits

Sl.No.	Item with specification	Qty (Nos.)
1.	AC alternator slip ring puller	1
2.	Adjustable spanner (pipe wrench 350 mm)	2
3.	Air blow gun with standard accessories	1
4.	Air impact wrench with standard accessories	4
5.	Air ratchet with standard accessories	4
6.	Allen Key set of 12 pieces (2mm to 14mm)	2
7.	Ammeter 300A/ 60A DC with external shunt	4
8.	Angle plate adjustable 250x150x175	1
9.	Angle plate size 200x100x200mm	2
10.	Anti theft device	2
11.	Anvil 50 Kgs with Stand	1
12.	Auto Electrical test bench	1
13.	Battery –charger	2
14.	Battery terminal cleaner tool	2
15.	Battery tester	1

16.	Belt Tensioner gauge	1
17.	Blow Lamp 1 litre	2
18.	Caliper inside 15 cm Spring	4
19.	Calipers outside 15 cm spring	4
20.	Car Jet washer	1
21.	Car stereo	1
22.	Chisel 10 cm flat	4
23.	Chisels cross cut 200 mm X 6mm	4
24.	Circlip pliers Expanding and contracting type 15cm and 20cm each	2
25.	Clamps C 100mm	2
26.	Clamps C 150mm	2
27.	Clamps C 200mm	2
28.	Cleaning tray 45x30 cm.	4
29.	Copper bit soldering iron 0.25 Kg	4
30.	Cylinder bore gauge capacity 20 to 160 mm	4
31.	DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms	4
32.	Depth micrometer 0-25mm	4
33.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)	4
34.	Distributor –Duel advance type, reluctance type	1 each
35.	Dividers 15 cm Spring	4
36.	Drift Punch Copper 15 Cm	4
37.	Drill point angle gauge	1
38.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4
39.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
40.	Electric testing screw driver	4
41.	Electrical horn (different types)	1 each
42.	Engineer's square 15 cm. Blade	4
43.	Executive Auto Electrical tool kit	1
44.	Feeler gauge 20 blades (metric)	1
45.	File flat 20 cm bastard	4
46.	File, half round 20 cm second cut	4
47.	File, Square 20 cm second cut	4
48.	File, Square 30 cm round	4
49.	File, triangular 15 cm second cut	4
50.	Files assorted sizes and types including safe edge file (20 Nos)	2 set
51.	Flat File 25 cm second cut	4
52.	Flat File 35 cm bastard	4
53.	Glow plug tester	2
54.	Granite surface plate 1600 x 1000 with stand and cover	1
55.	Grease Gun	1
56.	Growler	4
57.	Hacksaw frame adjustable 20-30 cm	10
58.	Hammer Ball Peen 0.75 Kg	2
59.	Hammer Chipping 0.25 Kg	2
60.	Hammer copper 1 Kg with handle	2
61.	Hammer Mallet	2
62.	Hammer Plastic	2
63.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2

64.	Hand reamers adjustable 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	2sets
65.	Hand Shear Universal 250mm	2
66.	Hand vice – 37 mm	2
67.	High rate discharge tester (cell tester)	1
68.	Holder, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required	As required
69.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
70.	Insulated Screw driver 20 cm x 9mm blade	4
71.	Insulated Screw driver 30 cm x 9mm blade	4
72.	Left cut snips 250mm	4
73.	Lifting jack screw type 3 ton, 5ton & 20 Ton capacity	1 each
74.	Magneto spanner set with 8 spanners	1 set
75.	Magnifying glass 75mm	2
76.	Marking out table 90X60X90 cm.	1
77.	Multimeter digital	5
78.	Multi-point fuel injection pump	1
79.	Oil can 0.5/0.25 liter capacity	2
80.	Oil Stone 15 cm x 5 cm x 2.5 cm	1
81.	Oscilloscope 20MHz	2
82.	Outside micrometer 0 to 25 mm	4
83.	Outside micrometer 25 to 50 mm	4
84.	Outside micrometer 50 to 75 mm	1
85.	Outside micrometer 75 to 100 mm	1
86.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	2 sets
87.	Pipe cutting tool	2
88.	Pipe flaring tool	2
89.	Pliers combination 20 cm.	2
90.	Pliers flat nose 15 cm	2
91.	Pliers round nose 15 cm	2
92.	Pliers side cutting 15 cm	2
93.	Portable electric drill Machine	1
94.	Portable headlight aiming kit	1
95.	Prick Punch 15 cm	4
96.	Punch Letter 4mm (Number)	2 set
97.	Right cut snips 250mm	4
98.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm	4
99.	Scriber 15 cm	2
100.	Scriber with scribing black universal	2
101.	Set of stock and dies - Metric	2 sets
102.	Shear Tin Man's 450 mm x 600mm	4
103.	Sheet Metal Gauge	2
104.	Sher Tinmans 300mm	8
105.	Soldering Copper Hatchet type 500gms	5
106.	Spanner Clyburn 15 cm	1
107.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
108.	Spanner T. flocks for screwing up and up-screwing inaccessible positions	2

109.	Spanner, adjustable 15cm.	2
110.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	2
111.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	2
112.	Spark lighter	2
113.	Spark plug spanner 14mm x 18mm x Size	2
114.	Steel measuring tape 10 meter in a case	2
115.	Steel rule 15 cm inch and metric	2
116.	Steel rule 30 cm inch and metric	2
117.	Straight edge gauge 2 ft.	1
118.	Straight edge gauge 4 ft.	1
119.	Stud extractor set of 3	2 sets
120.	Stud remover with socket handle	1
121.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	2
122.	Tachometer (Counting type)	1
123.	Taps and Dies complete sets (5 types)	1 set
124.	Taps and wrenches - Metric	2 sets
125.	Telescope gauge	4
126.	Temperature gauge 0-100 deg c	2
127.	Tester sparking plug 'NEON' Type	1
128.	Thermostat	2
129.	Thread pitch gauge metric, BSW	1
130.	Timing lighter	1
131.	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
132.	Trammel 30 cm	2
133.	Universal puller for removing pulleys, bearings	1
134.	V' Block 75 x 38 mm pair with Clamps	2
135.	Vrnier caliper 0-300 mm with least count 0.02mm	4
136.	Vice grip pliers	2
137.	Voltmeter 50V/DC	5
138.	Wire Gauge (metric)	5
139.	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	1
140.	4 Point relays	2
141.	5 Point relays	2

C. General Installation/ Machineries

Sl.No.	Item with specification	Qty (Nos.)
1.	Air bag simulator	1
2.	Air conditioned MPFI vehicle with auto transmission and accessories	1
3.	Air conditioning service Unit (Car)	1
4.	Air conditioning trainer kit	1
5.	Alternator assembly used for LMV	2
6.	Arbor press hand operated 2 ton capacity	1
7.	Bench lever shears 250mm Blade x 3mm Capacity	1
8.	Cut section Model of Mock layout of a motor car –electrical system – working model	1
9.	Demonstration board Ignition system, ignition coil	1 set

10.	Demonstration board of CRDI system working model	1
11.	Demonstration board of MPFI system working model	1
12.	Discrete Component Trainer / Basic Electronics Trainer	1
13.	Drilling machine bench to drill up to 12mm dia along with accessories	1
14.	Dual Magnetization Yoke : AC / HWDC, 230 VAC, 50Hz	1
15.	Electronic engine control module	1 set
16.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia	1
17.	Liquid penetrant Inspection kit	1 set
18.	Memory keeper / Battery backups	1
19.	Multi scan tool /ECU diagnostics kit	1
20.	Petrol Engine(4-stroke) Motor Cycle/Scooter along with special tools and accessories	1
21.	Pipe Bending Machine (Hydraulic type) 12mm to 30mm	1
22.	Pneumatic rivet gun	2
23.	Spring tension tester	1
24.	Starter motor axial type, pre-engagement type & Co-axial type	1each
25.	Trolley type portable air compressor single cylinder with 45 liters	1
26.	Ultrasonic Injection cleaning equipment	1
27.	Welding plant Oxy-Acetylene complete (high pressure)	2
28.	Welding Transformer (150-300 Amps)	1
29.	Wiper motor assembly	2
30.	Working Model of power windows	1

D. List of consumable:

Sl.No.	Description	Quantity
1.	Assortment of diodes / electronic components	As required
2.	Automatic Transmission oils	As required
3.	Backing Soda	As required
4.	Battery cleaner spray	As required
5.	Battery- SMF	As required
6.	Brake fluids	As required
7.	Chalk, Prussian blue.	As required
8.	Chemical compound for fasteners	As required
9.	Diesel	As required
10.	Different type gasket material	As required
11.	Different type of oil seal	As required
12.	Drill Twist (assorted)	As required
13.	Emery paper - 36–60 grit , 80–120	As required
14.	Fender cover	As required
15.	Gear oils	As required
16.	Hacksaw blade (consumable)	As required
17.	Hand rubber gloves tested for 5000 V	5 pair

18.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required	As required
19.	Hydrometer	8
20.	Jumper wires	As required
21.	Lapping abrasives	As required
22.	Leather Apron	5
23.	Petrol	As required
24.	Power steering oil	As required
25.	Radiator Coolants	As required
26.	Safety glasses	As required
27.	Steel wire Brush 50mmx150mm	5

E. Workshop Furniture

Sl. No.	Description	Quantity
1.	Book shelf (glass panel) 6½ ‘ x 3’ x 1½’	As required
2.	Computer Chair	1+1
3.	Computer Table	1+1
4.	Desktop computer and related MS office software	1+1
5.	Discussion Table 8’ x 4’ x 2½ ‘	2
6.	Fire Extinguishers, first- aid box	As required
7.	Instructional Material – NIMI Books/Ref.books	As required
8.	Internet connection with all accessories	As required
9.	Laser printer	1
10.	LCD projector/ LED /LCD TV (42”)	1
11.	Multimedia DVD for Automotive application/subjects	As required
12.	Online UPS 2KVA	1
13.	Stools	21
14.	Storage Rack 6½ ‘ x 3’ x 1½’	As required
15.	Storage shelf 6½ ‘ x 3’ x 1½’	As required.
16.	Suitable class room furniture	As required
17.	Suitable Work Tables with vices	As required
18.	Tool Cabinet - 6½ ‘ x 3’ x 1½’	2
19.	Trainees locker 6½ ‘ x 3’ x 1½’	2 Nos. to accommodate 20 Lockers

**List of tools & Equipment for the Trade of
Mechanic Auto Electrical & Electronics - Engineering Drawing
(Note : Facilities available in Draughtsman trade can be utilized)**

TRAINEE'S TOOLS KIT

Sl. No.	Name of the items	Quantity
1.	Draughtsman drawing instrument box	20+1 set
2.	Set square celluloid 45 ⁰ (250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30 ⁰ -60 ⁰ (250 X 1.5 mm)	20+1 set
4.	Mini drafter	20+1 set
5.	Drawing board (700mm x500 mm) IS: 1444	20+1 set

GENERAL MACHINERY SHOP OUTFIT

Sl. No.	Name & Description of Machine	Quantity
1.	Draughtsman table	20 Nos.
2.	Draughtsman stool	20Nos.