



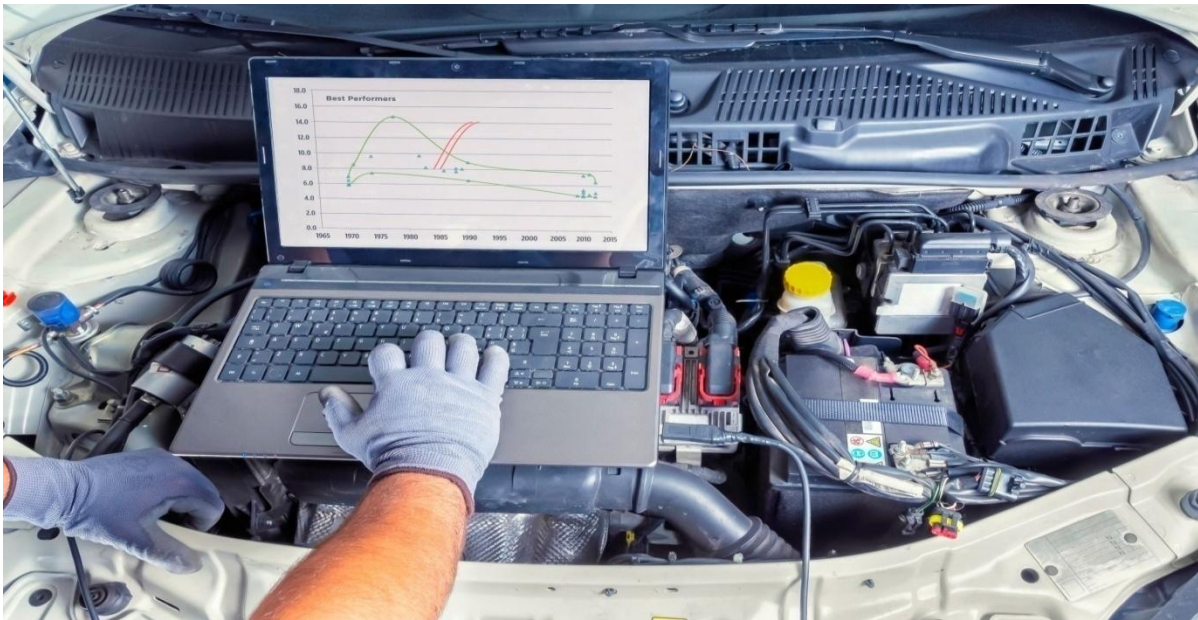
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

MECHANIC AUTO ELECTRICAL & ELECTRONICS

(Duration: One Year)

**CRAFTSMEN TRAINING SCHEME (CTS)
NSQF LEVEL - 4**



SECTOR – AUTOMOTIVE



Directorate General of Training

MECHANIC AUTO ELECTRICAL & ELECTRONICS

(Engineering Trade)

(Revised in 2019)

Version: 1.2

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

Developed By

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1. COURSE INFORMATION

During the one-year duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Calculation Science and Employability Skills related to job role. In addition to this a candidate is entrusted to make/do project work and extra-curricular activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The broad components covered under Professional Skill subject are as below:-

The trainee begins with safety aspect in general and specific to the trade, identification of tools & equipment, raw materials used. The trainee will perform precision measurements on the components and compare parameters with specifications used in automotive workshop. He learns to carry out basic fitting operations used in the workshop practices and inspection of dimensions. The trainee performs grinding of cutting tools and surface finishing operations in the given job. He learns to inspect the auto component using Non-destructive testing methods, to identify the hydraulic and pneumatic components in a vehicle. Constructs electrical circuits and performs basic electrical testing in a vehicle. Apply safe working practices and environment regulation in an automotive workshop. He identifies the major components of LMV/HMV and dashboard gauges. Performs the wiring circuits and the electrical components in the vehicle, troubleshoots different wiring circuits in vehicle and prepare different electrical joints. He learns to check and overhaul the ignition system, service and test battery, inspects power steering control module and troubleshoot. He identifies and checks ABS components, troubleshoots in all electrical circuits, diagnosis for all comfort system. He also understands the constructional features and working principles of MPFI system and different types of sensors in engine. The trainee identifies EDC components, sensors, actuators, major components of car AC, automotive lighting system and carries out repair & maintenance.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

Mechanic Auto Electrical & Electronics trade under CTS is one of the courses delivered nationwide through network of ITIs. The course is of one-year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Workshop Calculation science, Engineering Drawing and Employability Skills) imparts requisite core skills, knowledge and life skills. After passing out the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Candidates need broadly to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and repair & maintenance work.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship programme in different types of industries leading to a National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE

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

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	1000
2	Professional Knowledge (Trade Theory)	280
3	Workshop Calculation & Science	80
4	Engineering Drawing	80
5	Employability Skills	160
	Total	1600

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment** (Internal) during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by **Controller of examinations, DGT** as per the guidelines. The pattern and marking structure is being notified by DGT from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices.	<ul style="list-style-type: none"> • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.

(b) Weightage in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	<ul style="list-style-type: none"> • Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	<ul style="list-style-type: none"> • High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Electrician, Automobile; 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.

Reference NCO-2015:

- (i) 7412.0701 - Electrician, Automobile

4. GENERAL INFORMATION

Name of the Trade	Mechanic Auto Electrical & Electronics
Trade Code	DGT/1124
NCO - 2015	7412.0701
NSQF Level	Level – 4
Duration of Craftsmen Training	One year (1600 Hours)
Entry Qualification	Passed 10 th class examination with Science and Mathematics or its equivalent.
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, LV, DEAF
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space norms	100 Sq. m (Including parking area)
Power norms	3 KW
Instructors Qualification for:	
1. Mechanic Auto Electrical & Electronics Trade	<p>B.Voc/Degree in Automobile/ Mechanical Engineering/ Electrical /Electronics & communication Engineering (with specialization in Automobile) from AICTE / UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Automobile/ Mechanical / Electrical Engineering / Electronics & communication Engineering (with specialization in automobile) from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/NAC passed in the trade of "Mechanic Auto Electrical & Electronics"/ "Mechanic Motor Vehicle" with three years' experience in the relevant field.</p> <p>Essential Qualification: Relevant National Craft Instructor Certificate (NCIC) in any of the</p>

	<p>variants under DGT.</p> <p>NOTE: - Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.</p>
2. Workshop Calculation & Science	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC in any one of the engineering trades with three years' experience.</p> <p><u>Essential Qualification:</u> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;">OR</p> <p>NCIC in RoDA or any of its variants under DGT</p>
3. Engineering Drawing	<p>B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>NTC/ NAC in any one of the Electrical trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience.</p> <p><u>Essential Qualification:</u> National Craft Instructor Certificate (NCIC) in relevant trade</p> <p style="text-align: center;">OR</p> <p>NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.</p>

4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills from DGT institutes. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) OR Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills from DGT institutes.				
5. Minimum Age for Instructor	21 Years				
List of Tools and Equipment	As per Annexure – I				
Distribution of training on Hourly basis: (Indicative only)					
Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	Employability Skills
40 Hours	25 Hours	7 Hours	2 Hours	2 Hours	4 Hours

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES (TRADE SPECIFIC)

1. Use different types of tools and work shop equipment in the Auto work shop following safety precautions.
2. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.
3. Use of different type of fastening and locking devices in a vehicle.
4. Perform basic fitting operations used in the work shop practices and inspection of dimensions.
5. Produce components using bending process in the given work piece.
6. Construct electrical circuits and test its parameters by using electrical measuring instruments.
7. Perform basic electrical testing in a vehicle.
8. Perform battery testing and charging operations.
9. Construct basic electronic circuits and testing.
10. Manufacture components with different types of welding processes in the given job.
11. Identify the hydraulic and pneumatic components in a vehicle.
12. Check & Interpret Vehicle Specification data and VIN, Select & operate various Service Station Equipments.
13. Identify the major components of LMV/HMV and dashboard gauges.
14. Identify and Check wiring circuits and the electrical components in the vehicle.
15. Trace /troubleshoot different wiring circuits in vehicle and prepare different electrical joints.
16. Check and overhaul the ignition system.
17. Apply appropriate rule and tools for starting and charging system and diagnose & rectify faults.
18. Understand the constructional features and working principles of EDC/MPFI system.
19. Inspect power steering control module and troubleshoot in power steering.
20. Diagnosis for all comfort system.
21. Demonstrate the skill of automotive lighting system and their troubleshooting.
22. Troubleshoots in all electrical circuits.

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Use different types of tools and work shop equipment in the Auto work shop following safety precautions.	Identify the different types of hand and power tools used in the automotive work shop.
	Operate various tools and work shop equipment.
2. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.	Measure all dimensions in accordance with standard specifications and tolerances by using precision measuring instruments.
	Measure the parameters related with the vehicle components for its effective operation by matching with manufacturer's specification using different gauges
3. Use of different type of fastening and locking devices in a vehicle.	Identify the different type of fasteners and locking devices used in the vehicle.
	Use different types of locking devices correctly.
	Specify the bolt and nut threads.
	Practice on removing the damaged studs and bolts.
4. Perform basic fitting operations used in the work shop practices and inspection of dimensions.	Mark according to drawing by using marking tools on flat surfaces.
	Hack saw and file the job using different methods and perform in accordance with the standard specifications and tolerances.
	Drilling and reaming on flat surfaces.
	Identify and use hand tools for internal and external threading with taps and dies.
	Measure all dimensions in accordance with standard specification and tolerances.
5. Produce components using bending process in the given work piece.	Ascertain and select tools, equipment and materials for the job and make this available for use in a timely manner.
	Plan and organize the work for pipe bending operations.
	Perform bending, soldering and brazing operations in accordance with standard operating procedure using appropriate tools.

	Check accuracy/correctness of the job using appropriate measuring instruments.
6. Construct electrical circuits and test its parameters by using electrical measuring instruments.	Plan and organize the work for basic electrical operations.
	Select the tools, instruments and materials required to do the job.
	Comply with safety rules when performing the basic electrical operations.
	Perform electrical wire joints, form electrical circuits and test basic electrical parameters as per the circuit drawings and operating procedures.
7. Perform basic electrical testing in a vehicle.	Plan and organize the work for auto electrical component testing.
	Tracing the auto electrical components in a vehicle.
	Test continuity and voltage drop in the electrical circuits.
	Operate the electrical components in a vehicle and test lamps.
8. Perform battery testing and charging operations.	Ascertain and select tools and materials for the job.
	Comply with safety rules when performing the following operations.
	Plan and select different methods for charging the battery.
	Perform battery testing as per the operating procedure.
9. Construct basic electronic circuits and testing.	Plan and select different types of basic electronic components and measuring instruments.
	Construct and test the basic electronic gate circuits and its components as per the standard procedure.
10. Manufacture components with different types of welding processes in the given job.	Plan and select appropriate method to produce components with welding process.
	Comply with safety rules when performing the above operations.
	Mark according to the drawing using marking tools on the job.
	Select appropriate tools and equipment to perform the above operations.
	Set up and produce component as per standard operating procedure.

11. Identify the hydraulic and pneumatic components in a vehicle.	Comply with safety rules when performing the following operations.
	Locate and identify the hydraulic components in a vehicle.
	Locate and identify the pneumatic components in a vehicle.
12. Check & Interpret Vehicle Specification data and VIN, Select & operate various Service Station Equipments	Identify of different type of vehicle.
	Identify the different vehicle specification data and information
	Demonstrate the garage, service station different equipment
13. Identify the major components of LMV/HMV and dashboard gauges.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan work in compliance with standard safety norms.
	Identify the parts of Diesel/Petrol engine.
	Identify different gauges fitted on the dashboard and check for proper functioning.
	Perform daily checks before starting the engine.
	Start the engine and allow it to warm up.
	Identify the problem in functionality of particular Gauge fitted on dashboard and record the reading and compare it with standard reading.
	Repair / Replace the defective gauges as per standard operating practice
	Check for proper functionality.
	Stop the engine
14. Identify and Checkwiring circuits and the electrical components in the vehicle.	Comply with safety rules when performing the above jobs.
	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan work in compliance with standard safety norms.
	Identify Personal Protective Equipment and use the same as per related working environment.
	Locate and identify the electrical components in a vehicle by using wiring diagram.

	Locate and identify the power sources of various controls of electrical circuits.
15. Trace /troubleshoot different wiring circuits in vehicle and prepare different electrical joints.	Diagnosis and remedy for-Speedometer shows no operation., ,
	Diagnosis and remedy for fuel level meter shows no operation
	Diagnosis and remedy for coolant temp meter shows no operation
	Diagnosis and remedy for Oil pressure light shows no lighting
16. Check and overhaul the ignition system.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Identify Personal Protective Equipment and use the same as per related working environment.
	Plan and organize work for overhaul the ignition system.
	Check all components of ignition system physically, electrically and replace if required.
	Diagnosis the possible causes for hard or no start of engine related to ignition system.
	Diagnosis the possible causes for hard or no start of engine related to fuel system.
17. Apply appropriate rule and tools for starting and charging system and diagnose & rectify faults.	Check Charging system for proper functioning as per manufacturer guidelines.
	Check alternator for proper functioning
	Remove alternator from the vehicle
	Overhaul and check alternator for proper function
	Refit Alternator to the vehicle and check for functioning
	Check starting system for proper functioning as per manufacturer guidelines.
	Check starter for proper functioning
	Remove starter from the vehicle.
	Overhaul and check starter for proper function
	Refit starter to the vehicle and check for functioning
18. Understand the constructional features and working principles	Identify EDC components/ sensors,
	Test sensors /actuators.
	Identify various components of MPFI system.

of EDC/MPFI system.	Test MPFI components and replace if necessary.
	Check delivery from fuel Pump.
	Replace fuel filter.
	Fault finding in Electronic circuit and remedies using scan tool.
19. Inspect power steering control module and troubleshoot in power steering.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan and organize work for overhaul the starting system with safety norms.
	Check power steering and its components for proper functioning.
	Flush power steering.
	Check fluid and fluid pressure of power steering circuit.
	Diagnosis and trouble for power steering system.
20. Diagnosis for all comfort system.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan and organize work to check the components of automatic transmission system with safety norms.
	Identify and locate the components of Carr AC system in a given vehicle.
	Check charge state of refrigerant.
	Check AC system and its components for proper functioning.
	Check and replace/adjust compressor belt tension.
	Carry out the diagnostic procedure for the following trouble. No cooling. Intermittent cooling. Insufficient cooling. Abnormal noise from compressor, magnetic clutch, condenser, evaporator, and blower. High pressure gauge—Pressure high and low. Low pressure gauge Pressure high and low.
21. Demonstrate the skill of automotive lighting system and their troubleshooting.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan and organize work to check the components of lighting circuit.
	Read the wiring circuit of lighting of the given vehicle.
	Operate and check the function of combination switch and

	other light switches.
	Check the lights whether glow or not.
	Replace the defective bulbs/fuse/faulty wire/electrical or electronic components.
	Check fluid level light, engine oil pressure light, brake warning light.
	Align head light for proper focus.
	Repair and rectify any other faults in the light circuit.
22. Trouble shoots in all electrical circuits.	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	Plan and organize work to check the components of lighting circuit.
	Carry out the diagnostic procedure for the following troubles in the improper functioning electrical accessories.
	<ul style="list-style-type: none"> a) Improper functioning of horn. b) Improper functioning of wiper and washer circuit. c) Improper functioning of power window. d) Improper functioning of flasher circuit. e) Improper functioning of immobilizer system. f) Improper functioning of seat belt circuit. g) Improper functioning of air bag system. h) Improper functioning of car radio wiring.

7. TRADE SYLLABUS

SYLLABUS – MECHANIC AUTO ELECTRICAL & ELECTRONICS			
Duration: One Year			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 125Hrs; Professional Knowledge 35Hrs	Use different types of tools and work shop equipment in the Auto work shop following safety precautions.	1. Familiarization with institute, Job opportunities in the automobile sector, Machinery used in Trade.(10 hrs) 2. Types of work done by the students in the shop floor. (15 hrs)	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.(07hrs)
		3. Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. (08 hrs) 4. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers.(07 hrs) 5. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of Used engine oil.(08 hrs) 6. Energy saving Tips of ITI electricity Usage.(02 hrs)	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.

			(07hrs)
		<p>7. 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.(40hrs)</p> <p>8. Practice to measure a wheel base of a vehicle with measuring tape.(12hrs)</p> <p>9. Practice to measure valve spring tension using spring tension tester.(08hrs)</p> <p>10. Practice to remove wheel lug nuts with use of an air impact wrench Practice on General workshop tools & power tools.(15hrs)</p>	<p>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 pein, 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 circlips pliers. Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing. (21hrs)</p>
Professional Skill 50 Hrs;	Perform precision measurements on	11. Measuring practice on Cam height, Camshaft Journal	Systems of measurement, Description, care & use of -

Professional Knowledge 14 Hrs	the components and compare parameters with specifications used in automotive work shop practices.	<p>dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers.(12 hrs)</p> <p>12. 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.(04 hrs)</p> <p>13. Measuring practice on valve spring free length.(02 hrs)</p> <p>14. Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges.(04 hrs)</p> <p>15. Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges.(04 hrs)</p> <p>16. Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator.(06 hrs)</p> <p>17. Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge.(04 hrs)</p> <p>18. Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler</p>	<p>Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge. (14hrs)</p>
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		<p>gauge.(06 hrs)</p> <p>19. Practice to check engine manifold vacuum with vacuum gauge.(04 hrs)</p> <p>20. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting.(04 hrs)</p>	
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p>	<p>Use different types of tools and work shop equipment in the Auto work shop following safety precautions.</p> <p>Use of different type of fastening and locking devices in a vehicle.</p>	<p>21. Practice on General cleaning, checking and use of nut, bolts, & studs etc.(16 hrs)</p> <p>22. Removal of stud/bolt from blind hole. (06 hrs)</p> <p>23. Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. (20 hrs)</p> <p>24. Practice on Hacksawing and filing to given dimensions. (08 hrs)</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. 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. Limits, Fits & Tolerances:- Definition of limits, fits & tolerances with examples used in auto components.(14hrs)</p>
<p>Professional Skill 50 Hrs;</p> <p>Professional</p>	<p>Perform basic fitting operations used in the work shop practices and</p>	<p>25. Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to</p>	<p>Drilling machine - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill</p>

Knowledge 14 Hrs	inspection of dimensions.	<p>be observed while using a drilling machine.(16 hrs)</p> <p>26. Practice on Tapping a Clear and Blind Hole, Selection of tap drill Size, use of Lubrication, Use of stud extractor. (16 hrs)</p> <p>27. Cutting Threads on a Bolt/ Stud. (08 hrs)</p> <p>28. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface. (10 hrs)</p>	<p>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. (14 hrs)</p>
Professional Skill 25Hrs; Professional Knowledge 07 Hrs	Produce components using bending process in the given work piece.	<p>29. Practice on making Rectangular Tray.(10 hrs)</p> <p>30. Pipe bending, Fitting nipples unions in pipes. Soldering and Brazing of Pipes.(15hrs)</p>	<p>Sheet metal - State the various common metal Sheets used in Sheet Metal shop</p> <p>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.(07 hrs)</p>
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Construct electrical circuits and test its parameters by using electrical measuring instruments.	<p>31. Practice in joining wires using soldering Iron, Construction of simple electrical circuits.(16hrs)</p> <p>32. Measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers.(09 hrs)</p>	<p>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. (07 hrs)</p>
Professional Skill 25 Hrs;	Perform basic electrical testing in	33. Diagnose series, parallel, series-parallel circuits using	Fuses & circuit breakers, Ballast resistor, Stripping wire

Professional Knowledge 07 Hrs	a vehicle.	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.(25 hrs)	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.(07 hrs)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Perform battery testing and charging operations.	34. Cleaning and topping up of a lead acid battery, testing battery with hydrometer. (08 hrs) 35. Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging.(08 hrs) 36. Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. (05 hrs) 37. Testing of relay and solenoids and its circuit.(04 hrs)	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.(07 hrs)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Construct basic electronic circuits and testing.	38. Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality.(15 hrs) 39. Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. (10 hrs)	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. (07 hrs)
Professional Skill 50 Hrs;	Manufacture components with	40. Practice to make straight beads and Butt, Lap & T	Introduction to welding and Heat Treatment Welding

Professional Knowledge 14 Hrs	different types of welding processes in the given job.	<p>joints Manual Metal Arc Welding. (32 hrs)</p> <p>41. Setting of Gas welding flames, practice to make a straight beads and joints Oxy - Acetylene welding Film on Heat treatment process. (18 hrs)</p>	<p>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.(14 hrs)</p>
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Identify the hydraulic and pneumatic components in a vehicle.	<p>42. Practice on Liquid penetrant testing method and Magnetic particle testing method. (24 hrs)</p> <p>43. Identification of Hydraulic and pneumatic components used in vehicle.(06 hrs)</p> <p>44. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. (14 hrs)</p> <p>45. Identification of components in Air brake systems.(06 hrs)</p>	<p>Non-destructive Testing Methods- Importance of Nondestructive Testing In Automotive Industry, Definition of NDT, Liquid penetrant and Magnetic particle testing method - Portable Yoke method</p> <p>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</p>

			<p>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.</p> <p>Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator).(14 hrs)</p>
<p>Professional Skill 25Hrs;</p> <p>Professional Knowledge 07 Hrs</p>	<p>Check & Interpret Vehicle Specification data and VIN. Select & operate various Service Station Equipments.</p>	<p>46. Identification of different type of Vehicle. (04 hrs)</p> <p>47. Demonstration of vehicle specification data.(06 hrs)</p> <p>48. Identification of vehicle information Number (VIN). (04 hrs)</p> <p>49. Demonstration of Garage, Service station equipments. (04 hrs)</p> <p>50. Vehicle hoists - Two post and four post hoist, Engine hoists, Jacks, Stands.(07 hrs)</p>	<p>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. (07 hrs)</p>
<p>Professional Skill 25Hrs;</p> <p>Professional Knowledge</p>	<p>Identify the major components of LMV/HMV and dashboard gauges.</p>	<p>51. Identification of parts in a diesel engine of LMV/ HMV.(08 hrs)</p> <p>52. Practice on starting and stopping of diesel engines.</p>	<p>Introduction to Engine: Principle & working of 4-stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI),</p>

07 Hrs		(12 hrs) 53. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.(05 hrs)	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. (07 hrs)
Professional Skill 25Hrs; Professional Knowledge 07 Hrs	Identify and Checkwiring circuits and the electrical components in the vehicle.	54. Practice to identify components and their locations indicated on the wiring diagram.(10 hrs) 55. Practice to identify the power source, ground connection, and controls for electrical circuits using a wiring diagram.(15 hrs)	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 colourcodes.- 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),

			<p>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. (07 hrs)</p>
<p>Professional Skill 25Hrs;</p> <p>Professional Knowledge 07 Hrs</p>	<p>Trace /troubleshoot different wiring circuits in vehicle and prepare different electrical joints.</p>	<p>56. 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.(25 hrs)</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. (07 hrs)</p>
<p>Professional Skill 50 Hrs;</p> <p>Professional</p>	<p>Check and overhaul the ignition system.</p>	<p>57. Check and replace ignition coil, overhauling Distributor Assembly.(08 hrs)</p> <p>58. Checking ignition timing,</p>	<p>Ignition principles and Faraday's laws, Primary and secondary winding of transformer, Ignition</p>

Knowledge 14 Hrs		<p>Checking & changing a spark plug, Removing & replacing contact points.(12 hrs)</p> <p>59. Diagnosis- Possible causes and remedy for Engine cranks, but will not or hard to start, Poor fuel economy or engine performance.(12 hrs)</p> <p>60. Identification and testing of Hall effect sensor, Optical sensor. (08 hrs)</p> <p>61. Tracing and testing of sensor circuits.(05 hrs)</p> <p>62. Tracing of Distributor less ignition systems circuit. (05 hrs)</p>	<p>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. (14 hrs)</p>
Professional Skill 75Hrs; Professional Knowledge 21Hrs	Apply appropriate rule and tools for starting and charging system and diagnose & rectify faults.	<p>63. Removing starter motor from vehicle, and Performance test for pull-in test, Hold-in test, pinion (plunger) return test, No-load performance test. (13hrs)</p> <p>64. Solenoid test for Hold in coil open circuit, Armature test - Ground test, Open circuit test, pull-in coil open circuit test, field coil test. (08hrs)</p> <p>65. Inspections of brush length wear as per service manual. (06 hrs)</p> <p>66. Trouble shooting, possible causes and remedy for</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. (14 hrs)</p>

		<p>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. Growler testing for rotors.(08hrs)</p> <p>67. Checking a starting system, Jump-starting a vehicle.(06 hrs)</p>	
		<p>68. Checking a charging system for the Cause of undercharge, No charge, and over charge conditions. (04 hrs)</p> <p>69. Removing & replacing an alternator, Inspection of rotor for ground, open circuit - field coil resistance, slip ring surface, Fan, bearing.(08hrs)</p> <p>70. Inspection of stator for ground, open circuit, Inspection of Drive end bearing rotation, Rectifier, brush length compare with service manual.(06hrs)</p> <p>71. Slip ring surface. Inspecting & adjusting an engine drive belt, replacing an engine drive belt / pulleys / Tensioners and their alignments.(08hrs)</p> <p>72. Trouble shooting, possible causes and remedy for warning lamp does not glow when ignition switch is on,</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. (07hrs)</p>

		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.(08hrs)	
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Understand the constructional features and working principles of EDC/MPFI system.	<p>73. Identification of EDC components, sensors, Testing of sensors and actuators.(08hrs)</p> <p>74. Identification of various components of MPFI system.(06hrs)</p> <p>75. Testing of MPFI components and replacement if necessary. (04hrs)</p> <p>76. Check delivery from fuel Pump. (03hrs)</p> <p>77. Replacing a fuel filter.(04hrs)</p> <p>78. Identification of Electronic control Unit.(07hrs)</p> <p>79. Set up for testing, Testing of Electronic Control Circuit. (08hrs)</p> <p>80. Fault finding in Electronic circuit and remedies using scan tool.(10hrs)</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</p>

			<p>diagram, Electronic control unit</p> <ul style="list-style-type: none"> - 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. (14hrs)
		<p>81. Identification of various sensors installed in engine & its mounting. (10 hrs)</p> <p>82. Testing of Temperature sensor, Pressure sensor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor. (15 hrs)</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. (07 hrs)</p>
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p>	<p>Inspect power steering control module and troubleshoot in power steering.</p>	<p>83. Inspection of power steering control module circuit. (04 hrs)</p> <p>84. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system. (08 hrs)</p> <p>85. Trouble shooting and remedy for steering wheel feels heavy at low speed, poor recovery from turns, Vehicle pulls to one side during straight driving. (06 hrs)</p> <p>86. Identification of ABS components, checking of ABS warning lamp. (08 hrs)</p>	<p>Steering, suspension and Brakes:-</p> <p>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</p> <p>-Electronic control Unit, Fully</p>

		<p>87. Identification of Automatic transmission components. (08 hrs)</p> <p>88. Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler. (16 hrs)</p>	<p>hydraulically controlled transmission, Electronic shift programs, Manual selection. (14 hrs)</p>
<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p>	<p>Diagnosis for all comfort system.</p>	<p>89. 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.</p> <p>90. Checking a heating system, Compressor rotation test, air Gap check, Refrigerant recovery - evacuating - charging of A/c system.</p> <p>91. 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.</p> <p>92. Diagnosis test for high pressure gauge pressure high low, pressure gauge for pressure high 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. (14hrs)</p>

Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Demonstrate the skill of automotive lighting system and their troubleshooting.	<p>93. Trace the light circuit - test bulbs, align head lamps, Aiming headlights.(02 hrs)</p> <p>94. Changing a headlight bulb, Checking of a head light switch and to replace if faulty.(02 hrs)</p> <p>95. Trouble shooting and remedy for Headlight - headlight do not light up, only one headlight does not light up, Only one beam ("Hi" or "Lo") does not light.(04 hrs)</p> <p>96. Trouble shooting and remedy for turn signal and hazard warning lights -Flash rate high or one side only flashes, No Flashing, flash rate low.(04 hrs)</p> <p>97. Trouble shooting and remedy for clearance, tail and license plate lights -All lights do not light up, some lights do not light up.(02hrs)</p> <p>98. Trouble shooting and remedy for Back-up light - Back-up lights do not light up.(02 hrs)</p> <p>99. Trouble shooting and remedy for Brake lights - Brake lights do not light up, Brake light stay on.(02 hrs)</p> <p>100.Trouble shooting and remedy for fuel meter and fuel gauge unit - Fuel meter shows no operation or incorrect operation.(02hrs)</p>	<p>Discharge (HID) headlights. Headlight & dimmer circuits, Park & tail light 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> <p>(14 hrs)</p>
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<p>Professional Skill 50 Hrs;</p> <p>Professional Knowledge 14 Hrs</p>	Trouble shoots in all electrical circuits.	<p>107. Trouble shooting and remedy for Horn- No horn operation, poor sound quality, horn sounds continuously and to replace the horn if faulty.(12 hrs)</p> <p>108. Remove and install wiper motors and wiper switches.(08 hrs)</p> <p>109. Checking & replacing wiper blades.(08 hrs)</p> <p>110. Trouble shooting and remedy for windshield wiper and washer - no operation, intermittent operation, continuous operation, and wipers will not park.(06 hrs)</p> <p>111. Diagnose causes for improper operation of the windshield washer system and to replace the pump if faulty.(08 hrs)</p> <p>112. Diagnose the power window system for - all power window motors do not operate, some switches do not operate.(08 hrs)</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 pre-tensioners, Tire pressure monitoring systems 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)., Importance of E/E Architecture. (14 hrs)</p>
In plant Training/Project Work			

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Science (Common for one year course) (80Hrs)
2. Engineering Drawing (80Hrs)
3. Employability Skills (Common for all CTS trades) (160Hrs)

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

LIST OF TOOLS AND EQUIPMENT			
Mechanic Auto Electrical & Electronics (for Batch of 20 Candidates)			
S. No.	Name of the Tools& Equipment	Specification	Quantity
A. TRAINEES TOOL KIT			
1.	Allen Key set of 12 pieces	2mm to 14mm	5+1 nos.
2.	Back probe tools		5+1 nos.
3.	Caliper inside	15 cm Spring	5+1 nos.
4.	Calipers outside	15 cm spring	5+1 nos.
5.	Center Punch	10 mm. Dia. x 100 mm.	5+1 nos.
6.	Dividers	15 cm Spring	5+1 nos.
7.	Electrician Screw Driver	250mm	5+1 nos.
8.	Hammer ball peen	0.5 kg with handle	5+1 nos.
9.	Hands file	20 cm. Second cut flat	5+1 nos.
10.	Logic probe		5+1 nos.
11.	Pliers combination	20 cm.	5+1 nos.
12.	Screw driver	20cm.X 9mm. Blade	5+1 nos.
13.	Screw driver	30 cm. X 9 mm. Blade	5+1 nos.
14.	Scriber	15 cm	5+1 nos.
15.	Spanner D.E. set of 12 pieces	6mm to 32mm	5+1 nos.
16.	Spanner, ring set of 12 metric sizes	6 to 32 mm.	5+1 nos.
17.	Spanners socket with speed handle, T-bar, ratchet and universal	upto 32 mm set of 28 pieces with box	5+1 nos.
18.	Steel rule 30 cm inch and metric		5+1 nos.
19.	Steel tool box with lock and key (folding type)	400x200x150 mm	5+1 nos.
20.	Test light		5+1 nos.
21.	Wire cutter and stripper		5+1 nos.
B. TOOLS, INSTRUMENTS AND GENERAL SHOP OUTFIT			
25.	AC alternator slip ring puller		1 no.
26.	Adjustable spanner	pipe wrench 350 mm	2 nos.
27.	Air blow gun with standard accessories		1 no.
28.	Air impact wrench with standard		4 nos.

	accessories		
29.	Air ratchet with standard accessories		4 nos.
30.	Allen Key set of 12 pieces	2mm to 14mm	2 nos.
31.	Ammeter	300A/ 60A DC with external shunt	4 nos.
32.	Angle plate adjustable	250x150x175	1 no.
33.	Angle plate size	200x100x200mm	2 nos.
34.	Anti theft device		2 nos.
35.	Anvil	50 Kgs with Stand	1 no.
36.	Auto Electrical test bench		1 no.
37.	Battery -charger		2 nos.
38.	Battery terminal cleaner tool		2 nos.
39.	Battery tester		1 no.
40.	Belt Tensioner gauge		1 no.
41.	Blow Lamp	1 litre	2 nos.
42.	Caliper inside	15 cm Spring	4 nos.
43.	Calipers outside	15 cm spring	4 nos.
44.	Car Jet washer		1 no.
45.	Car stereo		1 no.
46.	Chisel	10 cm flat	4 nos.
47.	Chisels cross cut	200 mm X 6mm	4 nos.
48.	Circlip pliers Expanding and contracting type	15cm and 20cm each	2 nos.
49.	Clamps C	100mm	2 nos.
50.	Clamps C	150mm	2 nos.
51.	Clamps C	200mm	2 nos.
52.	Cleaning tray	45x30 cm.	4 nos.
53.	Copper bit soldering iron	0.25 Kg	4 nos.
54.	Cylinder bore gauge capacity	20 to 160 mm	4 nos.
55.	DC Ohmmeter	0 to 300 Ohms, mid scales at 20 Ohms	4 nos.
56.	Depth micrometer	0-25mm	4 nos.
57.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)		4 nos.
58.	Distributor -Duel advance type, reluctance type		1 each
59.	Dividers	15 cm Spring	4 nos.
60.	Drift Punch Copper	15 Cm	4 nos.
61.	Drill point angle gauge		1 no.

62.	Drill twist	1.5 mm to 15 mm (various sizes) by 0.5 mm	4 nos.
63.	Electric Soldering Iron 230 V 25 watts	230 V 60 watts	2 each
64.	Electric testing screw driver		4 nos.
65.	Electrical horn (different types)		1 each
66.	Engineer's square	15 cm. Blade	4 nos.
67.	Executive Auto Electrical tool kit		1 no.
68.	Feeler gauge 20 blades (metric)		1 no.
69.	File flat	20 cm bastard	4 nos.
70.	File, half round	20 cm second cut	4 nos.
71.	File, Square	20 cm second cut	4 nos.
72.	File, Square	30 cm round	4 nos.
73.	File, triangular	15 cm second cut	4 nos.
74.	Files assorted sizes and types including safe edge file (20 Nos)		2 set
75.	Flat File	25 cm second cut	4 nos.
76.	Flat File	35 cm bastard	4 nos.
77.	Glow plug tester		2 nos.
78.	Granite surface plate	1600 x 1000 with stand and cover	1 no.
79.	Grease Gun		1 no.
80.	Growler		4 nos.
81.	Hacksaw frame adjustable	20-30 cm	10 nos.
82.	Hammer Ball Peen	0.75 Kg	2 nos.
83.	Hammer Chipping 0	.25 Kg	2 nos.
84.	Hammer copper	1 Kg with handle	2 nos.
85.	Hammer Mallet		2 nos.
86.	Hammer Plastic		2 nos.
87.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm		2 nos.
88.	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
89.	Hand Shear Universal	250mm	2 nos.
90.	Hand vice -	37 mm	2 nos.
91.	High rate discharge tester (cell tester)		1 no.
92.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required		As required

93.	Hollow Punch set of seven pieces 6mm to 15mm		2 sets each
94.	Insulated Screw driver	20 cm x 9mm blade	4 nos.
95.	Insulated Screw driver	30 cm x 9mm blade	4 nos.
96.	Left cut snips	250mm	4 nos.
97.	Lifting jack screw type	3 ton, 5ton & 20 Ton capacity	1 each
98.	Magneto spanner set with 8 spanners		1 set
99.	Magnifying glass	75mm	2 nos.
100.	Marking out table	90X60X90 cm.	1 no.
101.	Multimeter digital		5 nos.
102.	Multi-point fuel injection pump		1 no.
103.	Oil can	0.5/0.25 liter capacity	2 nos.
104.	Oil Stone	15 cm x 5 cm x 2.5 cm	1 no.
105.	Oscilloscope	20MHz	2 nos.
106.	Outside micrometer	0 to 25 mm	4 nos.
107.	Outside micrometer	25 to 50 mm	4 nos.
108.	Outside micrometer	50 to 75 mm	1 no.
109.	Outside micrometer	75 to 100 mm to 300 mm 100 mm	1 no.
110.	Philips Screw Driver set of 5 pieces		2 sets
111.	Pipe cutting tool		2 nos.
112.	Pipe flaring tool		2 nos.
113.	Pliers combination	20 cm.	2 nos.
114.	Pliers flat nose	15 cm	2 nos.
115.	Pliers round nose	15 cm	2 nos.
116.	Pliers side cutting	15 cm	2 nos.
117.	Portable electric drill Machine		1 no.
118.	Portable headlight aiming kit		1 no.
119.	Prick Punch	15 cm	4 nos.
120.	Punch Letter 4mm (Number)		2 set
121.	Right cut snips	250mm	4 nos.
122.	Rivet sets snap and Dolly combined	3mm, 4mm, 6mm	4 nos.
123.	Scriber	15 cm	2 nos.
124.	Scriber with scribing black universal		2 nos.
125.	Set of stock and dies - Metric		2 sets
126.	Shear Tin Man's	450 mm x 600mm	4 nos.
127.	Sheet Metal Gauge		2 nos.
128.	Sher Tinmans	300mm	8 nos.
129.	Soldering Copper Hatchet type	500gms	5 nos.
130.	Spanner Clyburn	15 cm	1 no.
131.	Spanner D.E. set of 12 pieces	6mm to 32mm	4 nos.
132.	Spanner T. flocks for screwing up and		2 nos.

	up-screwing inaccessible positions		
133.	Spanner, adjustable	15cm.	2 nos.
134.	Spanner, ring set of 12 metric sizes	6 to 32 mm.	2 nos.
135.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box		2 nos.
136.	Spark lighter		2 nos.
137.	Spark plug spanner	14mm x 18mm x Size	2 nos.
138.	Steel measuring tape	10 meter in a case	2 nos.
139.	Steel rule	15 cm inch and metric	2 nos.
140.	Steel rule	30 cm inch and metric	2 nos.
141.	Straight edge gauge	2 ft.	1 no.
142.	Straight edge gauge	4 ft.	1 no.
143.	Stud extractor set of 3		2 sets
144.	Stud remover with socket handle		1 no.
145.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm		2 nos.
146.	Tachometer (Counting type)		1 no.
147.	Taps and Dies complete sets (5 types)		1 set
148.	Taps and wrenches - Metric		2 sets
149.	Telescope gauge		4 nos.
150.	Temperature gauge	0-100 deg c	2 nos.
151.	Tester sparking plug 'NEON' Type		1 no.
152.	Thermostat		2 nos.
153.	Thread pitch gauge metric, BSW		1 no.
154.	Timing lighter		1 no.
155.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
156.	Trammel	30 cm	2 nos.
157.	Universal puller for removing pulleys, bearings		1 no.
158.	V' Block	75 x 38 mm pair with Clamps	2 nos.
159.	Vrnier caliper	0-300 mm with least count 0.02mm	4 nos.
160.	Vice grip pliers		2 nos.
161.	Voltmeter	50V/DC	5 nos.
162.	Wire Gauge (metric)		5 nos.
163.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	1 no.
164.	4 Point relays		2 nos.
165.	5 Point relays		2 nos.
C. GENERAL INSTALLATION/ MACHINERIES			
166.	Air bag simulator		1 no.

167.	Air conditioned MPFI vehicle with auto transmission and accessories		1 no.
168.	Air conditioning service Unit (Car)		1 no.
169.	Air conditioning trainer kit		1 no.
170.	Alternator assembly used for LMV		1 no.
171.	Arbor press hand operated 2 ton capacity		1 no.
172.	Bench lever shears 250mm Blade x 3mm Capacity		1 no.
173.	Cut section Model of Mock layout of a motor car -electrical system - working model		1 no.
174.	Demonstration board Ignition system, ignition coil		1 set
175.	Demonstration board of CRDI system working model		1 no.
176.	Demonstration board of MPFI system working model		1 no.
177.	Discrete Component Trainer / Basic Electronics Trainer		1 no.
178.	Drilling machine bench to drill up to 12mm dia along with accessories		1 no.
179.	Dual Magnetization Yoke : AC / HWDC, 230 VAC, 50Hz		1 no.
180.	Electronic engine control module		1 set
181.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia		1 no.
182.	Liquid pen ⁸ trant Inspection kit		1 set
183.	Memory keeper / Battery backups		1 no.
184.	Multi scan tool /ECU diagnostics kit		1 no.
185.	Petrol Engine(4-stroke) Motor Cycle/Scooter along with special tools and accessories		1 no.
186.	Pipe Bending Machine (Hydraulic type) 12mm to 30mm		1 no.
187.	Pneumatic rivet gun		2 nos.
188.	Spring tension tester		1 no.
189.	Starter motor axial type, pre-engagement type & Co-axial type		1each
190.	Trolley type portable air compressor single cylinder with 45 liters capacity Air		1 no.
191.	Ultra sonic Injection cleaning e		1 no.

	quipment		
192.	Welding plant Oxy-Acetylene complete (high pressure)		2 nos.
193.	Welding Transformer (150-300 Amps)		1 no.
194.	Wiper motor assembly		2 nos.
195.	Working Model of power windows		1 no.

D. LIST OF CONSUMABLES:

196.	Assortment of diodes / electronic components		As required
197.	Automatic Transmission oils		As required
198.	Backing Soda		As required
199.	Battery cleaner spray		As required
200.	Battery- SMF		As required
201.	Brake fluids		As required
202.	Chalk, Prussian blue.		As required
203.	Chemical compound for fasteners		As required
204.	Diesel		As required
205.	Different type gasket material		As required
206.	Different type of oil seal		As required
207.	Drill Twist (assorted)		As required
208.	Emery paper -	36-60 grit , 80-120	As required
209.	Fender cover		As required
210.	Gear oils		As required
211.	Hacksaw blade (consumable)		As required
212.	Hand rubber gloves tested for 5000 V		5 pair
213.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required		As required
214.	Hydrometer		8 nos.
215.	Jumper wires		As required
216.	Lapping abrasives		As required
217.	Leather Apron		5 nos.
218.	Petrol		As required
219.	Power steering oil		As required
220.	Radiator Coolants		As required
221.	Safety glasses		As required
222.	Steel wire Brush 50mmx150mm		5 nos.

E. WORKSHOP FURNITURE

223.	Book shelf (glass panel)	6.5' x 3' x 1.5'	As required
224.	Computer Chair		1+1
225.	Computer Table		1+1
226.	Desktop Computer	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch. Licensed Operating System and Antivirus compatible with trade related software.	1+1
227.	Discussion Table	8' x 4' x 2.5'	2 nos.
228.	Fire Extinguishers, first- aid box		As required
229.	Instructional Material - NIMI Books/Ref.books		As required
230.	Internet connection with all accessories		As required
231.	Laser printer		1 no.
232.	LCD projector/ LED /LCD TV (42")		1 no.
233.	Multimedia DVD for Automotive application/subjects		As required
234.	Online UPS 2KVA		As required
235.	Stools		21 nos.
236.	Storage Rack	6.5' x 3' x 1.5'	As required
237.	Storage shelf	6.5' x 3' x 1.5'	As required.
238.	Suitable class room furniture		As required
239.	Suitable Work Tables with vices		As required
240.	Tool Cabinet -	6.5' x 3' x 1.5'	2 nos.
241.	Trainees locker	6.5' x 3' x 1.5'	2 Nos. to accommodate 20

Note: -

1. All the tools and equipment are to be procured as per BIS specification.
2. Internet facility is desired to be provided in the class room.

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum

List of Expert members participated for finalizing the course curriculum of Mechanic Auto Electrical & Electronics Trade			
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2.	G Satish Kumar, Manager	Ashok Leyland	Member
3.	GM Cholanrajan, Sr. Manager, Training	Lansun Toyota, Chennai	Member
4.	M Shanavas Khan,	Hinduja Foundries	Member
5.	Dr. Abhijit KR Mandal,	National Automotive Testing and R&D Infrastructure Project, Global, Automotive Research center, Chennai	Member
6.	Vadivelan	-Do-	Member
7.	Anatharaman, Proprietor,	Care Care Center, Chennai	Member
8.	M. K. Gupta	Maruthi Suzuki	Member
9.	Pandey, Director,	SRFMTTI, Anathapur	Member
10.	P. Thangapalam,	DM- Trg, Dailmer India	Member
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17.	T. N.Umashankar, Head Manufacturing	Delphi TVS Ltd.	Member
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ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprentice Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities

