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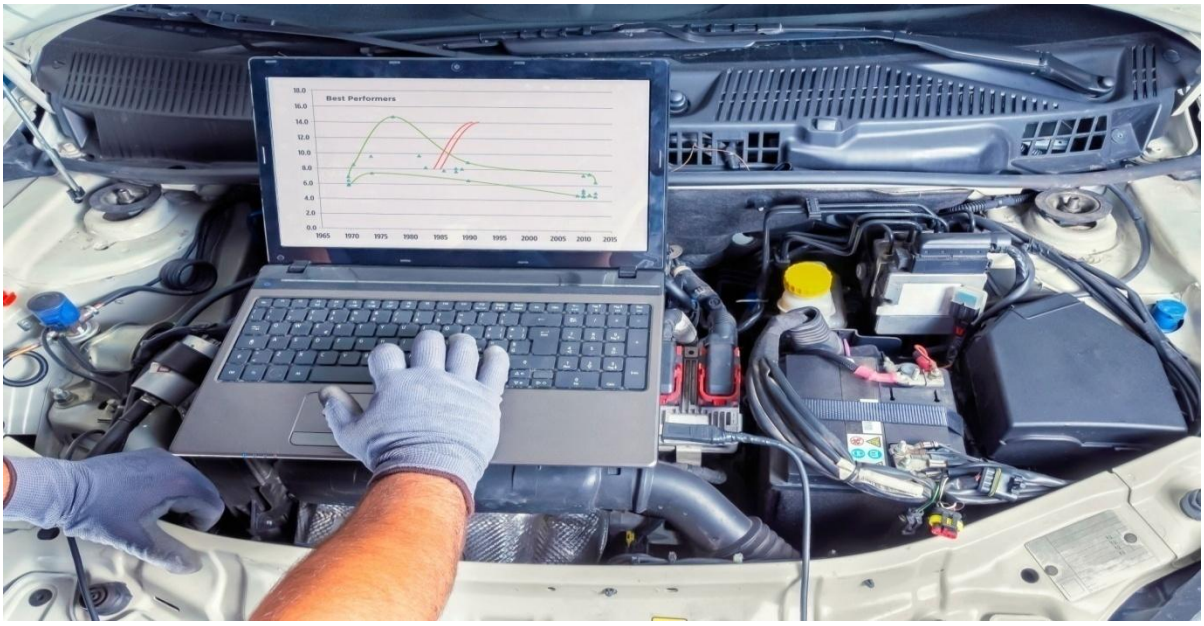
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

MECHANIC AUTO ELECTRICAL & ELECTRONICS

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)
NSQF LEVEL – 3.5



SECTOR – AUTOMOTIVE

कौशल बलम्
Directorate General of Training

MECHANIC AUTO ELECTRICAL & ELECTRONICS

(Engineering Trade)

(Revised in March 2023)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3.5

Developed By

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1. COURSE INFORMATION

During the one-year duration a candidate is trained on subjects Professional Skill, Professional Knowledge, 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 (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 jobsand 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 one year:-

S No.	Course Element	Notional Training Hours
		1st Year
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
3	Employability Skills	120
	Total	**1200**

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

4	On the Job Training (OJT)/ Group Project	150
5	Optional Courses (10th/ 12th class certificate along with ITI certification or add on short term courses)	240

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses.

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%.

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 some of 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
- Computer based multiple choice question examination
- Practical Examination

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 for formative assessment:

Performance Level	Evidence
(a) Marks 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.	• 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) Marks 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	• 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) Marks 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.	• 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-2015:7412.0701-Electrician, Automobile

Reference NOS:

I. ASC/N1406
II. ASC/N1405
III. ASC/N1438
IV. ASC/N1435
V. ASC/N9419
VI. PSS/N9401
VII. PSS/N9402

4. GENERAL INFORMATION

Name of the Trade	**Mechanic Auto Electrical & Electronics**
NCO - 2015	7412.0701
NOS Covered	ASC/N1405, ASC/N1406, ASC/N9419, PSS/N9401, PSS/N9402, ASC/N1438, ASC/N1435
NSQF Level	Level – 3.5
Duration of Craftsmen Training	One year (1200 hours + 150 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination
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	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. **OR** 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. **OR** NTC/NAC passed in the trade of **"Mechanic Auto Electrical & Electronics"/ "Mechanic Motor Vehicle"** with three years' experience in the relevant field. **Essential Qualification:** Relevant Regular / RPL variants of National Craft Instructor

	Certificate (NCIC) under DGT. ***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.***
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 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. **OR** NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 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. **OR** NTC/ NAC in any one of the engineering/ Draughtsman group of trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade OR Regular/RPL variants NCIC in RoDA or any of its variants under DGT

4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience **w**ith **short term ToT Course in** Employability Skills. (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.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

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.

5.1LEARNING OUTCOMES

1. Use different types of tools and work shop equipment in the Auto work shopfollowing safety precautions. (NOS: ASC/N1406)
2. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices. (NOS: ASC/N1406)
3. Use of different type of fastening and locking devices in a vehicle. (NOS: ASC/N1405)
4. Perform basic fitting operations used in the work shop practices and inspection of dimensions. (NOS: ASC/N1438)
5. Construct electrical circuits and test its parameters by using electrical measuring instruments. (NOS: ASC/N1406)
6. Perform basic electrical testing in a vehicle. (NOS: ASC/N1406)
7. Perform battery testing and charging operations. (NOS: ASC/N1406)
8. Construct basic electronic circuits and testing. (NOS: ASC/N1435)
9. Check & Interpret Vehicle Specification data and VIN, Select & operate various Service Station Equipment. (NOS: ASC/N1406)
10. Identify the major components of LMV/HMV and dashboard gauges. (NOS: ASC/N1406)
11. Identify and Check wiring circuits and the electrical components in the vehicle. (NOS: ASC/N1406)
12. Trace /troubleshoot different wiring circuits in vehicle and prepare different electrical joints. (NOS: ASC/N1406)
13. Check and overhaul the ignition system. (NOS: ASC/N1406)
14. Apply appropriate rule and tools for starting and charging system and diagnose & rectify faults. (NOS: ASC/N1406)
15. Identification and testing of electrical/ electronic controls in MPFI/CRDI systems (NOS: ASC/N9419)
16. Inspect power steering control module and troubleshoot in power steering. (NOS: ASC/N1406)
17. Diagnosis for all comfort system. (NOS: ASC/N1406)
18. Demonstrate the skill of automotive lighting system and their troubleshooting. (NOS: ASC/N1406)
19. Troubleshoots in all electrical circuits. (NOS: ASC/N1406)
20. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)

21. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)

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. (NOS: ASC/N1406)	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. (NOS: ASC/N1406)	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. (NOS: ASC/N1405)	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. (NOS: ASC/N1438)	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. Construct electrical circuits and test its	Plan and organize the work for basic electrical operations.
	Select the tools, instruments and materials required to do the job.

parameters by using electrical measuring instruments. (NOS: ASC/N1406)	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.
6. Perform basic electrical testing in a vehicle. (NOS: ASC/N1406)	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.
7. Perform battery testing and charging operations. (NOS: ASC/N1406)	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.
8. Construct basic electronic circuits and testing. (NOS: ASC/N1435)	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.
9. Check & Interpret Vehicle Specification data and VIN, Select & operate various Service Station Equipments. (NOS: ASC/N1406)	Identify of different type of vehicle.
	Identify the different vehicle specification data and information
	Demonstrate the garage, service station different equipment
10. Identify the major components of LMV/HMV and dashboard gauges. (NOS: ASC/N1406)	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
	Comply with safety rules when performing the above jobs.
11. Identify and Check wiring circuits and the electrical components in the vehicle. (NOS: ASC/N1406)	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.
12. Trace /troubleshoot different wiring circuits in vehicle and prepare different electrical joints. (NOS: ASC/N1406)	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
13. Check and overhaul the ignition system. (NOS: ASC/N1406)	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.

14. Apply appropriate rule and tools for starting and charging system and diagnose & rectify faults. (NOS: ASC/N1406)	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
15. Identification and testing of electrical/ electronic controls in MPFI/CRDI systems (NOS: ASC/N9419)	Identify EDC components/ sensors,
	Test sensors /actuators.
	Identify various components of 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.
16. Inspect power steering control module and troubleshoot in power steering. (NOS: ASC/N1406)	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.
17. Diagnosis for all comfort system. (NOS: ASC/N1406)	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.
18. Demonstrate the skill of automotive lighting system and their troubleshooting. (NOS: ASC/N1406)	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.
19. Trouble shoots in all electrical circuits. (NOS: ASC/N1406)	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. 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.
20. Read and apply engineering drawing for different application in the field of work. (NOS: PSS/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
21. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: PSS/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

7. TRADE SYLLABUS

SYLLABUS – MECHANIC AUTO ELECTRICAL & ELECTRONICS			
Duration: One Year			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
ProfessionalSkill112Hrs; ProfessionalKnowledge25Hrs	Use different types of tools and workshop equipment in the Auto work shop following safety precautions.	1. Familiarization with institute, Job opportunities in the automobile sector, Machinery used in Trade. 2. Types of work done by the students in the shop floor. 3. Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. 4. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. 5. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of used engine oil. 6. Energy saving Tips of ITI electricity Usage. 7. Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc., Layout a work piece-for line, circle, arcs and circles. 8. Practice on removing and refitting of Dash Board.	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 timetable. (07hrs) Occupational Safety & Health Importance of Safety and general Precautions to be observed in the shop. Basic firstaid,safetysigns-forDanger,Warning,caution&personalsafetymessage.Safehandlingof Fuel Spillage, Fire extinguishersusedfordifferenttypes offire.Safedisposaloftoxicdust,safehandlingandPeriodic 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. Hand & Power Tools:- Marking scheme, Marking material-

		Front, Rear bumpers and other electrical components	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, scriber, punches - prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet. Screwdrivers –blade screwdriver, Phillips screwdriver, Ratchet screw driver. 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
ProfessionalSkill28 Hrs; ProfessionalKnowledge04 Hrs	Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.	9. Practice on measuring the given component using precision measuring equipment like Vernier caliper, Micrometer	Systems of measurement, Description, care & use of-Micrometers - Outside and depth micrometer, Micrometer adjustments, Vernier calipers, Dial indicators, thread pitch gauge
ProfessionalSkill56 Hrs; Professio	Use different types of tools and workshop equipment in the Auto	10. PracticeonGeneralcleaning, checkinganduseof nut, bolts, & studs etc. 11. Removal of stud/bolt from blind hole.	Fasteners-Studyofdifferenttypes of screws, nuts, studs &bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where

nalKnowledge10 Hrs	workshop following safety precautions. Use of different type of fastening and locking devices in a vehicle.	12. Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. 13. Practice on Hacksawing and filing to given dimensions.	they are used. Washers & chemical compound scan be used to help secure these fasteners. 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.
ProfessionalSkill56 Hrs; Professional Knowledge 12 Hrs	Perform basic fitting operations used in the work shop practices and inspection of dimensions.	14. Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. 15. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor. 16. Cutting Threads on a Bolt/Stud. 17. 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.
ProfessionalSkill28 Hrs; ProfessionalKnowl	Construct electrical circuits and test its parameters by using electrical measuring	18. Practice in joining wires using soldering Iron, Construction of simple electrical circuits. 19. Measuring of current, voltage and resistance using	Basic electricity, Ground connections, Voltmeter, ammeter, Ohmmeter, Multimeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings.

edge07 Hrs	instruments.	digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers.	
ProfessionalSkill28 Hrs; ProfessionalKnowledge05 Hrs	Perform basic electrical testing in a vehicle.	20. 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, Capacitors and its applications, Capacitors in series and parallel.
ProfessionalSkill28 Hrs; ProfessionalKnowledge04 Hrs	Perform battery testing and charging operations.	21. Cleaning and topping up of a lead acid battery, testing battery with hydrometer. 22. Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging. 23. Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. 24. Testing of relay and solenoids and its circuit.	Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Thermisters, Thermocouples, Relays, Solenoids, Charging system circuit
ProfessionalSkill28 Hrs; ProfessionalKnowledge07 Hrs	Construct basic electronic circuits and testing.	25. Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality. 26. Construct and test simple logic circuits OR, AND &	Basic electronics: Description ofSemi-conductors,Solidstatedevices-Diodes,Transistors,Thyristors, Uni-Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches.

		NOT and Logic gates using switches.	
ProfessionalSkill28 Hrs; ProfessionalKnowledge04 Hrs	Check & Interpret Vehicle Specification data and VIN. Select & operate various Service Station Equipment's.	27. Identification of different type of Vehicle. 28. Demonstration of vehicle specification data. 29. Identification of vehicle information Number (VIN). 30. Demonstration of Garage, Service station equipments. 31. Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.	Auto Industry - History, leading manufacturers, development inautomobileindustry,trends,newproduct.BriefaboutMinistryofRoadtransport&Highways,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.
ProfessionalSkill28 Hrs; ProfessionalKnowledge07 Hrs	Identify the major components of LMV/ HMV and dashboard gauges.	32. Identification of parts in a diesel/petrol engine of LMV/HMV. 33. Practice on starting and stopping of diesel/petrol engines. 34. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.	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 gear shift 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.
Professional Skill28Hrs; Professional Knowledge	Identify and Check wiring circuits and the electrical components in	35. Practicetoidentifycomponentsandtheirlocationsindicatedonthewiringdiagram. 36. Practice to identify the power source, ground	Electrical and Electronic Components:- Switches-Description of Normally open, Normally closed, single pole single throwswitch (SPST), ganged, and mercury switches used in

07 Hrs	the vehicle.	connection, and controls for electrical circuits using a wiring diagram.	Automobile circuit. Description of Relay, ISO Relays, Solenoids, Buzzers. Resistors- Description of different type of resistors and their color codes - Fixed, stepped, and variable resistors- Rheostat, Potentiometer. Description of Diodes, Diode identification and ratings, zener diodes, Avalanche diodes, Light emitting diodes, photodiodes 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.
ProfessionalSkill28 Hrs; ProfessionalKnowledge05 Hrs	Trace /troubleshoot different wiring circuits in vehicle and prepare different electrical joints.	37. Diagnosis and remedy for – Speedometer shows no operation, fuel level meter shows no operation, coolant tempmeter shows no operation, Oil pressure light shows no lighting.	Wiring and circuitdiagrams- Automotive wiring. Comparison between solid and stranded primary wire. Description of wire size- Metric and American wire gauge (AWG), Importance of ground straps used in automotive wiring. Description of different type of terminals and connectors - Molded, multiple-wire hard shell, bulk head, weather - pack, metri-pack, heat-shrink covered butt connectors. Importance of printed circuit boards, wiring harnesses, wiring diagrams and color codes and circuit numbering. Study of common electrical and

			electronic symbols used in wiring diagrams.
ProfessionalSkill28 Hrs; Professional Knowledge 04 Hrs	Checkandoverhaultheignitionsystem.	37. Check andreplace ignitioncoil, Check ignitiontiming, Checking & changing a sparkplug 38. Diagnosis- Possiblecausesandremedy forEnginecranks,butwillnotorhardtostart,Poorfuelecon omyorengineperformance. 39. Identification and testing ofHalleffectsensor,Opticals ensor. 40. Tracing and testing of sensorcircuits. (05hrs) 41. TracingofDistributorlessignition systems circuit.	IgnitionprinciplesandPrimaryandsecondary winding of Ignition components, Spark plugs, Spark plug components, ballastresistorcoil,Dwellangle,Sparktiming. Battery power source, Description and function ofCapacitor/condenser,High-tensionleads, Inductionwiring,Halleffectsensors,Halleffectoperation,Optical type sensors Distributorless ignition systems, Insulatedcoils,Distributorlessignition systemtiming.
ProfessionalSkill56 Hrs; ProfessionalKnowledge10Hrs	Applyappropriateruleandtoolsfor starting and Chargingsystem anddiagnose&rectifyfaults.	42. Removingstartermotorfrom vehicle, and Performance test for pull-intest,Hold-intest,pinion(plunger)returntest,No-loadperformancetest. 43. Solenoid test for Hold in coilopen circuit, Armature test - Groundtest,Opencircuittest, pull-in coil open circuittest,field coiltest. 44. Inspectionsofbrushlengthwear as per service manual. 45. Troubleshooting, possible causes and remedy for startermotornotrunning,Startingmotorrunningbuttoslow(smalltorque),staringmotorrunning,butnotcranking engine.Noise,starting	Startingsystem-purposeofstarting system, Staring systemcomponents,Startermotorprinciples,studyofstartercontrolcircuits. Startermotorconstruction,Startermagnettypes, Starter motorengagement,Commutation,Switching, solenoid construction.

		motor does not stoprunning. Growler testing forrotors. 46. Checkingastartingsystem, Jump-startingavehicle.	
		47. Checking a charging systemfortheCauseofunder charge,Nocharge,and over charge conditions. 48. Removing&replacinganalter nator,Inspectionofrotorforg round,opencircuit - field coil resistance,slipringsurface,Fa n,bearing. 49. Inspectionofstatorforgroun d,opencircuit,InspectionofD riveendbearingrotation,Rect ifier,brushlengthcomparewi thservice manual. 50. Slipring surface. Inspecting&adjustingan enginedrivebelt,replacingan engine drive belt / pulleys/Tesnionsers andtheiralignments. 51. Troubleshooting,possibleca usesandremedyforwarningl ampdoesnotglow whenignitionswitchison, Warninglampglowsdimwhe nignitionswitchison,warning lamp 'on' while thealternatorisrunning,War ninglampglows'dim'whileth ealternatorisrunning,warnin glamp flickers considerably.	Chargingsystem-The purposeofChargingsystem,chargings ystemcomponents,chargingsystemcir cuit,Alternatorprinciples,Alternatingc urrent,Alternator components,Rectification,Phasewind ingconnections,Rotorcircuit,Voltager egulation,Systemoperating voltage, High voltagecharging systems, Rotor, Stator,Alternator end frames, Slip ring&brushassembly,Rectifierassemb ly,Alternatorcoolingfan.
Professio nalSkill84	Identification and testing of	52. IdentificationofEDCcompon ents, sensors,	ElectronicDieselcontrol-ElectronicDieselcontrolsystems,Com

Hrs; ProfessionalKnowledge12 Hrs	electrical/ electronic controls in MPFI/CRDI systems	testingofsensorsandactuators. 53. IdentificationofvariouscomponentsofMPFIsystem. 54. Testing of MPFI componentsandreplacementifnecessary. 55. CheckdeliveryfromfuelPump. Replacingafuelfilter. 56. IdentificationofElectroniccontrolUnit. 57. Set up for testing, Testing ofElectronicControlCircuit. 58. Fault findinginElectroniccircuitandremediesusingscan tool. 59. Identificationofvarioussensorsinstalledinengine& itsmounting. 60. TestingofTemperaturesensor,Pressuresenor,potentiometer,magneticinduction sensor, cam shaftsensor,crankshaftpositionsensor.	monRailDieselInjection(CRDI)system, Hydraulically actuated electronicallycontrolledunitinjector (HEUI) diesel injectionsystem. Sensors, actuators andECU(ElectronicControlUnit)used inDieselEngines. IntroductiontoElectronicfuelinjection (EFI)fuelsupplysystem,Multi-pointinjectionsystems(MPI/MPFI),EFI aircleaners,Electronicmufflers,EFIfuel supplysystemcomponents-DescriptionofFuelpumps,EFIsensors, Potentiometer,Auxiliaryairvalves,Idle speedcontroldevices, Inertiasensors. IntroductiontoEFIEngineManagement-EFIoperationModesofEFI,Idlespeedcontrolsystems,Feedback& looping,Coldstartsystems,Airmeasurement,Air-flowmonitoring,Variableintakemanifold system, Electrical functions, EFI wiring diagram, Electroniccontrolunit - ECU,EFIsystemECU,Electronic control unit settings,Enginespeedlimiting,Malfunctionindicatorlamp.ImportanceofDiagnosticTroubleCode(DTC)&itsgeneral format.Useofscantoolandretrievalsofcodes. EFIsensors-Description,location and function of IntakeTemperaturesensor,Massairflowsensor,Manifoldabsolutepressuressensor,Airvortexsensor,Fuelsystemsensor,Throttlepositionsensor,Exhaust

			gasoxygensensor, Crankanglesensor, Hall effectvoltagesensor.
ProfessionalSkill28 Hrs; ProfessionalKnowledge07 Hrs	Inspect power Steering control module and troubleshooting power steering.	61. Inspection of power steeringcontrolmodulecircuit. 62. Troubleshootingandremedy forsteeringwheelfeelsheavyatlowspeed,poorrecoveryfromturns,Vehiclepullstoonesideduringstraightdriving. 63. IdentificationofABScomponents,checkingof ABSwarninglamp. 64. Identification ofAutomatictransmissioncomponents. 65. Inspectionofshiftleverswitch,throttlepositionsensor,speedsensorandautomatic transmissionwiringharnesscoupler.	Steering, suspension andBrakes:-DescriptionofElectricpowerassistedsteering and it's wiring circuit. Basicelectricpower steering operation, Electronic adjustable-rate shock absorbers, Electricbrakes, Electro hydraulic braking (EHB), ABS brake system, Antilock brakingsystemoperation, Principlesof ABS braking, ABS master cylinder, Hydrauliccontrolunit, Wheelspeedsensors, ABSwith Electronic Brake force Distribution (EBD) control unit.Electroniccontroltransmission-ElectroniccontrolUnit,Fully hydraulically controlled transmission,Electronicshiftprograms,Manualselection.
ProfessionalSkill56 Hrs; ProfessionalKnowledge10 Hrs	Diagnosis for allcomfortsystem.	66. IdentificationofAirconditioningcomponents,PerformancetestonA/cunit,CheckingChargedstateofrefrigerant,Inspecting&adjustinganengine drivebelt,replacingan enginedrivebelt. 67. Checkingaheatingsystem, Compressor rotationtest,airGapcheck,Refrigerantrecovery-evacuating - chargingofA/csystem. 68. Replenishing compressor	Heating Ventilation Air Conditioning(HVAC) legislation, Vehicle heating, ventilation&coolingsystems, Basic air-conditioning principles, Air-conditioningcapacity, Air-conditioningrefrigerant, Humidity, Description and function of Fixedorifice,Controldevices,Thermostaticexpansionvalvesystem, Thermal expansionvalves, Air-conditioning compressors, Condensers &evaporators, Receiver drier, Lines &hoses, TX

		oillevelTroublediagnoseandremedyforNocoolingorwarm air, Cool air comes outonly intermittently, cool aircomesoutonlyathigh,Insufficient cooling, Abnormal noisefrom compressor Magnetic clutch, condenser, evaporator, blower motor. 69. Diagnosistestforhighpressuregaugepressurehighlow,pressuregaugefor pressurehighlow.	valveconstruction, Temperature monitoring thermostat, Refrigerants, Pressureswitches,Heatingelements. Air-conditioningECU,Ambientairtemperaturesensor,Servomotors,Electricservomotors,Automaticclimatecontrolsensors, Evaporatortemperaturesensor,Blowerspeedcontrol,Ventilationsystems.
ProfessionalSkill56 Hrs; ProfessionalKnowledge10 Hrs	Demonstrate theskill of automotivelightingsystemandtheirtroubleshooting.	70. Trace the light circuit - testbulbs,alignheadlamps,aimingheadlights. 71. Changingaheadlightbulb,checkingofaheadlightswitchandtoreplaceiffaulty. 72. Troubleshootingandremedy forHeadlight-headlightdonotlightup,only one headlight does notlightup,Onlyonebeam("Hi"or"Lo")doesnotlight. 73. Troubleshootingandremedy forturnsignalandhazard warning lights - Flashratehighoronesideonly flashes,NoFlashing,flashrate low. 74. Troubleshootingandremedy forclearance,tailandlicenseplatelights-Alllights do not light up, somelightsdonotlightup. 75. Troubleshootingandremedy	Discharge(HID)headlights.Headlight& dimmercircuits,Park & tail light circuits, Brakelight circuits, turn signal circuit,Corneringlights,Foglightscircuit, interior lights-courtesy,readingandinstrumentpanel lights, Smart lighting , Reverselights.

		forBack-uplight-Back-uplightsdonotlightup. 76. Troubleshootingandremedy forBrakelights-Brake lights do not light up,Brakelightstayon. 77. Troubleshootingandremedy forfuelmeterandfuel gauge unit - Fuel metershowsnooperationor incorrectoperation. 78. Troubleshootingandremedy forEnginecoolantTemp(ECT) meterandECTSensor-Enginecoolanttempmetersh owsnooperationorincorrect operation. 79. Lighting system, Lamps/lightbulbs,Lamp/ligh tbulbinformation,LEDlightin g,Headlights-descriptionofstandardseale dbeam,halogensealedbeam, compositeandhighintensity discharge(HID)headlights. 80. Headlight & dimmer circuits,Park&taillightcircuit s,Brakelightcircuits,turnsign alcircuit,Corneringlights,Fog lightscircuit,interiorlights-courtesy,readingandTrouble shooting and remedy for oilpressure light - Oil pressurewarning light does not lightupwhenignitionswitchis on at engineoff. 81. Troubleshootingandremedy	

		forbrakeandparking brake warning light-Brake warning light does notlightupwhenfluidflowlevel,Brakewarninglightdoesnotlightupwhenparking brake pull up, Brakewarninglightsstay on. 82. Troubleshootingandremedy forinteriorlight-Interiorlightdonotlightup. 83. Tracethewiringcircuitoftraffi csignalflasherslightcircuit-tracing defects in theflashercircuits,replacing fusebulb.	
ProfessionalSkill56 Hrs; ProfessionalKnowledge10 Hrs	Troubleshootsinallelectricalcircuits.	84. Troubleshootingandremedy forHorn-Nohornoperation,poorsoundquality,hornsoundscontinuously and to replacethehorn iffaulty. 85. Removeandinstallwipermotors and wiper switches. 86. Checking&replacingwiperblades. 87. Troubleshootingandremedy for windshield wiperand washer - no operation,intermittent operation,continuousoperation,andwiperswillnotpark. 88. Diagnosecausesforimproperoperationofthewindshieldwashersystemand to replace the pump iffaulty. 89. Diagnose the power windowsystemfor-	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. 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

		allpowerwindowmotorsdon otoperate,someswitchesdo notoperate.	Transport)., Importance of E/E Architecture.
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work.	**ENGINEERING DRAWING:** Introduction to Engineering Drawing and Drawing Instruments – Conventions Sizes and layout of drawing sheets Title Block, its position and content Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – Geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches. Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering – Single Stroke. Dimensioning Types of arrowhead Leader line with text Position of dimensioning (Unidirectional, Aligned) Symbolic representation – Different symbols used in the related trades of Mechanic Auto Body Repair / Electrical and Electronics / Diesel / Tractor / Two and Three-wheeler. Concept and reading of Drawing in Concept of axes plane and quadrant Concept of Orthographic and Isometric projections Method of first angle and third angle projections (definition and difference) Reading of Job drawing related to Mechanic Auto Body Repair / Electrical and Electronics / Diesel / Tractor / Two and Three-wheeler trades.	
Workshop Calculation & Science: 40 hrs.			
Professional Knowledge WCS- 40 Hrs.	Demonstrate basic mathematical concept and principles to perform practical	**WORKSHOP CALCULATION & SCIENCE:** **Unit, Fractions** Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, substraction, multiplication & division Decimal fractions - Addition, subtraction, multilipication& division	

	operations. Understand and explain basic science in the field of study.	Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and suare root Simple problems using calculator Applications of pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction **Material Science** Types metals, types of ferrous and non-ferrous metals Physical and mechanical properties of metals Properties and uses of rubber, and insulating materials **Mass, Weight, Volume and Density** Mass, volume, density, weight and specific gravity. Related problems for mass, volume, density, weight and specific gravity **Speed and Velocity, Work, Power and Energy** Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation Speed and velocity - Related problems on speed & velocity Work, power, energy, HP, IHP, BHP and efficiency **Basic Electricity** Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC,DC their comparison, voltage, resistance and their units Conductor, insulator, types of connections - series and parallel Ohm's law, relation between V.I.R & related problems Electrical power, energy and their units, calculation with assignments Magnetic induction, self and mutual inductance and EMF generation Electrical power, HP, energy and units of electrical energy **Mensuration** Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles
In plant Training/Project Work		

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs.)

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/dgt.gov.in

ANNEXURE-I

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.	Auto Electrical test bench		1 no.
36.	Battery -charger		2 nos.
37.	Battery terminal cleaner tool		2 nos.
38.	Battery tester		1 no.
39.	Belt Tensioner gauge		1 no.
40.	Blow Lamp	1 litre	2 nos.
41.	Caliper inside	15 cm Spring	4 nos.
42.	Calipers outside	15 cm spring	4 nos.
43.	Car Jet washer		1 no.
44.	Car stereo		1 no.
45.	Chisel	10 cm flat	4 nos.
46.	Chisels cross cut	200 mm X 6mm	4 nos.
47.	Circlip pliers Expanding and contracting type	15cm and 20cm each	2 nos.
48.	Clamps C	100mm	2 nos.
49.	Clamps C	150mm	2 nos.
50.	Clamps C	200mm	2 nos.
51.	Cleaning tray	45x30 cm.	4 nos.
52.	Copper bit soldering iron	0.25 Kg	4 nos.
53.	DC Ohmmeter	0 to 300 Ohms, mid scales at 20 Ohms	4 nos.
54.	Depth micrometer	0-25mm	4 nos.
55.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)		4 nos.
56.	Distributor -Duel advance type, reluctance type		1 each
57.	Dividers	15 cm Spring	4 nos.
58.	Drift Punch Copper	15 Cm	4 nos.
59.	Drill point angle gauge		1 no.
60.	Drill twist	1.5 mm to 15 mm (various sizes) by 0.5 mm	4 nos.
61.	Electric Soldering Iron 230 V 25 watts	230 V 60 watts	2 each

62.	Electric testing screw driver		4 nos.
63.	Electrical horn (different types)		1 each
64.	Engineer's square	15 cm. Blade	4 nos.
65.	Executive Auto Electrical tool kit		1 no.
66.	Feeler gauge 20 blades (metric)		1 no.
67.	File flat	20 cm bastard	4 nos.
68.	File, half round	20 cm second cut	4 nos.
69.	File, Square	20 cm second cut	4 nos.
70.	File, Square	30 cm round	4 nos.
71.	File, triangular	15 cm second cut	4 nos.
72.	Files assorted sizes and types including safe edge file (20 Nos)		2 set
73.	Flat File	25 cm second cut	4 nos.
74.	Flat File	35 cm bastard	4 nos.
75.	Glow plug tester		2 nos.
76.	Granite surface plate	1600 x 1000 with stand and cover	1 no.
77.	Grease Gun		1 no.
78.	Growler		4 nos.
79.	Hacksaw frame adjustable	20-30 cm	10 nos.
80.	Hammer Ball Peen	0.75 Kg	2 nos.
81.	Hammer Chipping 0	.25 Kg	2 nos.
82.	Hammer copper	1 Kg with handle	2 nos.
83.	Hammer Mallet		2 nos.
84.	Hammer Plastic		2 nos.
85.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm		2 nos.
86.	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
87.	Hand Shear Universal	250mm	2 nos.
88.	Hand vice -	37 mm	2 nos.
89.	High rate discharge tester (cell tester)		1 no.
90.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required		As required
91.	Hollow Punch set of seven pieces 6mm to 15mm		2 sets each
92.	Insulated Screw driver	20 cm x 9mm blade	4 nos.
93.	Insulated Screw driver	30 cm x 9mm blade	4 nos.

94.	Left cut snips	250mm	4 nos.
95.	Lifting jack screw type	3 ton, 5ton & 20 Ton capacity	1 each
96.	Magneto spanner set with 8 spanners		1 set
97.	Magnifying glass	75mm	2 nos.
98.	Marking out table	90X60X90 cm.	1 no.
99.	Multimeter digital		5 nos.
100.	Multi-point fuel injection pump		1 no.
101.	Oil can	0.5/0.25 liter capacity	2 nos.
102.	Oil Stone	15 cm x 5 cm x 2.5 cm	1 no.
103.	Oscilloscope	20MHz	2 nos.
104.	Outside micrometer	0 to 25 mm	4 nos.
105.	Outside micrometer	25 to 50 mm	4 nos.
106.	Outside micrometer	50 to 75 mm	1 no.
107.	Outside micrometer	75 to 100 mm to 300 mm 100 mm	1 no.
108.	Philips Screw Driver set of 5 pieces		2 sets
109.	Pliers combination	20 cm.	2 nos.
110.	Pliers flat nose	15 cm	2 nos.
111.	Pliers round nose	15 cm	2 nos.
112.	Pliers side cutting	15 cm	2 nos.
113.	Portable electric drill Machine		1 no.
114.	Portable headlight aiming kit		1 no.
115.	Prick Punch	15 cm	4 nos.
116.	Punch Letter 4mm (Number)		2 set
117.	Scriber	15 cm	2 nos.
118.	Scriber with scribing black universal		2 nos.
119.	Set of stock and dies - Metric		2 sets
120.	Soldering Copper Hatchet type	500gms	5 nos.
121.	Spanner Clyburn	15 cm	1 no.
122.	Spanner D.E. set of 12 pieces	6mm to 32mm	4 nos.
123.	Spanner T. flocks for screwing up and up-screwing inaccessible positions		2 nos.
124.	Spanner, adjustable	15cm.	2 nos.
125.	Spanner, ring set of 12 metric sizes	6 to 32 mm.	2 nos.
126.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box		2 nos.
127.	Spark lighter		2 nos.
128.	Spark plug spanner	14mm x 18mm x Size	2 nos.
129.	Steel measuring tape	10 meter in a case	2 nos.
130.	Steel rule	15 cm inch and metric	2 nos.
131.	Steel rule	30 cm inch and metric	2 nos.

132.	Straight edge gauge	2 ft.	1 no.
133.	Straight edge gauge	4 ft.	1 no.
134.	Stud extractor set of 3		2 sets
135.	Stud remover with socket handle		1 no.
136.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm		2 nos.
137.	Tachometer (Counting type)		1 no.
138.	Taps and Dies complete sets (5 types)		1 set
139.	Taps and wrenches - Metric		2 sets
140.	Telescope gauge		4 nos.
141.	Temperature gauge	0-100 deg c	2 nos.
142.	Tester sparking plug 'NEON' Type		1 no.
143.	Thermostat		2 nos.
144.	Thread pitch gauge metric, BSW		1 no.
145.	Timing lighter		1 no.
146.	Universal puller for removing pulleys, bearings		1 no.
147.	V' Block	75 x 38 mm pair with Clamps	2 nos.
148.	Vrnier caliper	0-300 mm with least count 0.02mm	4 nos.
149.	Vice grip pliers		2 nos.
150.	Voltmeter	50V/DC	5 nos.
151.	Wire Gauge (metric)		5 nos.
152.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	1 no.
153.	4 Point relays		2 nos.
154.	5 Point relays		2 nos.
C. GENERAL INSTALLATION/ MACHINERIES			
155.	Air bag simulator		1 no.
156.	Air conditioned MPFI vehicle with auto transmission and accessories		1 no.
157.	Air conditioning service Unit (Car)		1 no.
158.	Air conditioning trainer kit		1 no.
159.	Alternator assembly used for LMV		1 no.
160.	Arbor press hand operated 2 ton capacity		1 no.
161.	Cut section Model of Mock layout of a motor car -electrical system - working model		1 no.
162.	Demonstration board Ignition system, ignition coil		1 set
163.	Demonstration board of CRDI system		1 no.

	working model		
164.	Demonstration board of MPFI system working model		1 no.
165.	Discrete Component Trainer / Basic Electronics Trainer		1 no.
166.	Drilling machine bench to drill up to 12mm dia along with accessories		1 no.
167.	Electronic engine control module		1 set
168.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia		1 no.
169.	Memory keeper / Battery backups		1 no.
170.	Multi scan tool /ECU diagnostics kit		1 no.
171.	Petrol Engine(4-stroke) Motor Cycle/Scooter along with special tools and accessories		1 no.
172.	Starter motor axial type, pre-engagement type & Co-axial type		1each
173.	Trolley type portable air compressor single cylinder with 45 liters capacity Air		1 no.
174.	Ultrasonic Injection cleaning equipment		1 no.
175.	Wiper motor assembly		2 nos.
176.	Working Model of power windows		1 no.
177.	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
178.	Internet connection with all accessories		As required
179.	Laser printer		1 no.
180.	LCD projector/ LED /LCD TV (42")		1 no.
181.	Online UPS 2KVA		As required
D. LIST OF CONSUMABLES:			
182.	Assortment of diodes / electronic components		As required
183.	Automatic Transmission oils		As required
184.	Backing Soda		As required

185.	Battery cleaner spray		As required
186.	Battery- SMF		As required
187.	Brake fluids		As required
188.	Chalk, Prussian blue.		As required
189.	Chemical compound for fasteners		As required
190.	Diesel		As required
191.	Different type gasket material		As required
192.	Different type of oil seal		As required
193.	Drill Twist (assorted)		As required
194.	Emery paper -	36-60 grit , 80-120	As required
195.	Fender cover		As required
196.	Gear oils		As required
197.	Hacksaw blade (consumable)		As required
198.	Hand rubber gloves tested for 5000 V		5 pair
199.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables batteries round consumable blocks and other consumables as required		As required
200.	Hydrometer		8 nos.
201.	Jumper wires		As required
202.	Lapping abrasives		As required
203.	Leather Apron		5 nos.
204.	Petrol		As required
205.	Safety glasses		As required
206.	Steel wire Brush 50mmx150mm		5 nos.
E. WORKSHOP FURNITURE AND MATERIAL			
207.	Book shelf (glass panel)	6.5’ x 3' x 1.5'	As required
208.	Computer Chair		1+1
209.	Computer Table		1+1
210.	Discussion Table	8' x 4' x 2.5'	2 nos.
211.	Fire Extinguishers, first- aid box		As required
212.	Instructional Material - NIMI Books/Ref.books		As required
213.	Multimedia DVD for Automotive application/subjects		As required
214.	Stools		21 nos.
215.	Storage Rack	6.5’ x 3' x 1.5'	As required
216.	Storage shelf	6.5’ x 3' x 1.5'	As required.
217.	Suitable class room furniture		As required
218.	Suitable Work Tables with vices		As required

219.	Tool Cabinet -	6.5’ x 3' x 1.5'	2 nos.
220.	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.*

ANNEXURE-II

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 thecourse curriculum of Mechanic Auto Electrical & Electronics Trade			
S No.	**Name & Designation Shri/Mr./Ms.**	**Organization**	**Remarks**
1.	V Krishna Shankar, Gen. Manager,	Ashok Leyland	Chairman
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
11.	S. Gopinath, Sr. Manager	Crompton Greaves	Member
12.	R. A. Armstrong	TAFE	Member
13.	B. Muthukumar,	Toyoto Kirloskar, New Delhi	Member
14.	J. Dharsan, Asst. Mgr,	Toyoto Kirloskar, Bangalore	Member
15.	C. Prakash, Sr. Gen. Manager	Ashok Leyland	Member
16.	P. Palanivelan, Manger	TVS Sundram Fasteners ltd.	Member
17.	T. N.Umashankar, Head Manufacturing	Delphi TVS Ltd.	Member
18.	K. Aravind, Regional Trainer,	Bosch Ltd., Chennai	Member
19.	K. Mohankumar	TAFE	Member
20.	M. Sivaraman, Consultant	Delphi TVS	Member
Representatives from Academic/Professional Institutions			
21.	Dr. Ramesh A, Professor	D/o Mechanical Engineering IIT Madras	Member

22.	Dr. A.R. Mohanty Professor,	D/o Mechanical Engg IIT Kharagpur	Member
23.	Dr. Shankar Ram C S, Assistant Profesor	D/o Engineering Design IIT Madras	Member
24.	Prof. Nilesh J Vasa, Professor	IIT Chennai	Member
25.	Prof. G. Balaganesh, Professor	IIT Chennai	Member
26.	J. Rajakumar, Principal	Brakes India	Member
27.	S HorlyokChelladurai, Retd. ITI Principal		Member
DGT Coordinator			
28.	Shri T.C. Saravanabava,Deputy Director General (AT)	DGET Headquarters	Coordinator/ Member
Core Group			
29.	K.S. Rao, JDT,	NIMI, Chennai	Member
30.	Yuvraj, DDT	ATI Chennai	Member
31.	G. Venktesh, ADT	ATI Hyd	Member
32.	S.P. Rewaskar,	ATI, Hyd	Member
33.	T.N. Rudra, TO	ATI, Howrah	Member
34.	N. Ramesh Kumar, TO	ATI, Chennai	Member
35.	Akhilesh Pandey, TO	ATI, Mumbai	Member
36.	Vijayaraju, TO	ATI, Hyd	Member
37.	R. Rajesh Kanna, TO	ATI Chennai	Member
Champion ITIs			
38.	H.S. Kalara, Principal	Govt. ITI, Chandigarh	Member
39.	A. Duraiswamy, ATO,	Govt. ITI, Coimbattore	Member
40.	W. Nirmal Kumar Isarael, ATO	Govt. ITI, Trichy	Member
41.	K. Thaniarasu, ATO	Govt. ITI, Trichy	Member
42.	N. Durimurugan, TO	Govt. ITI, Chengalpattu	Member
43.	Ravindernath,	Govt. ITI, Ambattur	Member
44.	Palanikumar	Govt. ITI, Pudukotai, TN	Member

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


कौशलं बलम्