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

COMPETENCY BASED CURRICULUM

MECHANIC MOTOR VEHICLE

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL: 4

SECTOR – AUTOMOTIVE

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Kolkata-700091

MECHANICAL MOTOR VEHICLE

(Engineering Trade)

(Revised in August 2025)

Version: 3.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL : 4

Directorate General of Training

Developed By

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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1. COURSE INFORMATION

During the two-year duration, a candidate is trained on subjects- Professional Skill, Professional Knowledge, and Employability Skills related to job roles. 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:

FIRST YEAR: This year will cover the safety aspect in general and specific to the trade, identification of tools & equipment, raw materials used. The trainee will perform Measuring & marking by using various Measuring & Marking tools. The trainee will be able to plan and perform basic fastening and fitting operations. Familiarize with basics of electricity, test and measure the electrical parameter. Skilling practice on maintenance of batteries being done. He will practice making various welding joints by using Arc and gas welding, trace and identify various hydraulics and pneumatics components and identify components in Air and Hydraulic Brake system.

The candidate will be able to dismantle Diesel Engine of LMV as per given standard procedures. Able to achieve skill on Overhauling of Cylinder Head, valve train, Piston, connecting rod assembly, crankshaft, flywheel and mounting flanges, spigot and bearings, camshaft etc. practice reassembling all parts of engine in correct sequence as per workshop manual. Perform testing on engine. Also, the trainee practice on repair and maintenance of Cooling, lubrication, Intake & Exhaust system of Engine. Perform maintenance of diesel fuel system, FIP, Governor and monitor emission of vehicle. Practice on repair, maintenance and overhaul of Starter, alternator and perform Execute troubleshooting in engine of LMV/HMV.

SECOND YEAR: In the second year, the trainee will learn to perform overhauling of light vehicle/Heavy Vehicle transmission units including Gear box, Single plate clutch assembly, Diaphragm clutch assembly, Constant mesh Gear box, synchromesh gear box, gear linkages, Propeller shaft, Universal Slip Joint, Rear axle assembly, Differential assembly. The trainee will perform overhauling of light vehicle Chassis units, adhering to the specifications and tolerances for the vehicle and the manufacturer's approved overhauling methods, Standard repair methods, health and safety requirements etc. the trainee will learn how to overhaul, repair and service Shackle, Leaf spring, Front axle, Front and rear suspension, Steering Gearbox- worm and roller type, Steering Gearbox- Reticulating ball type, Master cylinder, Tandem Master cylinder, Front and rear brake, Wheel cylinder , Vacuum booster, Air servo unit, Air tank (reservoir) etc. The trainee will also learn to carry out wheel balancing and Wheel Alignment within acceptable limits.

The trainee will perform Trouble shooting of engine. Plan & service Electronic Control Unit and check functionality. Diagnose & rectify the defects in vehicle to ensure functionality of vehicle.

The trainees will carry out overhauling of charging system. Also, the trainee will perform overhauling of starting system. Troubleshoot electrical components of vehicle and ascertain repair. Overhaul, service and testing Vehicle Air Conditioning system, its parts and check functionality. The trainee will also learn to drive vehicle following Traffic Regulations and maintenance of good road conduct.

The trainee will also learn about Electric Vehicles (EV) basic components and their working.

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 Motor Vehicle Trade under CTS is one of the popular courses delivered nationwide through a network of ITIs. The course is of two years duration. It mainly consists of Domain area and Core area. In the Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Candidates broadly need to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, 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 knowledge, core skills & employability skills while performing the job and machining work.
- Check the job/components as per drawing for functioning identify and rectify errors in job/components.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS:

- Can join industry as Automotive 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 appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to 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	2nd Year
1.	Professional Skill (Trade Practical)	840	840
2.	Professional Knowledge (Trade Theory)	240	300
3.	Employability Skills	120	60
Total		**1200**	**1200**
On the Job Training (OJT)/ Group Project *		150	150
Optional Courses**		240	240
Grand Total		**1590**	**1590**

** The trainee has to undergo 150 hours of mandatory OJT (On the Job Training) at nearby industry or wherever industry not available then group project has to be done with the supervision of the trade instructor for every year.*

*** Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for obtaining 10th/ 12th class certificate from NIOS along with ITI certification, or, short term courses for extra skills/knowledge.*

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his/her 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 have 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.cstaricalcutta.gov.in or 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 DGT as per the guidelines. The pattern and marking structure is being notified by DGT India 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 percentage for Trade Practical and Formative assessment are 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 assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards Occupational Safety, Health and Environment (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 examination body. The following marking pattern to be adopted for formative assessment:

Marks Allotted During Assessment	Performance Level	Evidence
Marks between 60% to 75%	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.
Marks above 75% to 90%	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.
Marks Above 90%	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

Mechanic, Automobile; repairs overhauls and services motor vehicles to keep them in good running condition. Examines vehicle to ascertain nature and location of defects either by running engine or driving vehicle on road. Dismantles partially or completely defective unit or parts of vehicle such as engine, gear box, rear axle, front axle, steering assembly, radiator, etc. according to nature of repairs to be done, using hoist, jack, pullers, hand tools and other devices. Measures essential parts like cylinder, bores piston, sizes crank pins etc. using gauges, micrometer and other precision tools and gets cylinders re-bored, liners filled, valve seats refaced, bearings re-metalled etc. as necessary. Repairs or overhauls and assembles engine by performing tasks similar to those of Mechanic Petrol or Diesel Engine such as replacing defective parts, scrapping bearings, grinding valves, setting timing, cleaning injectors, etc. according to maker's specification. Replaces or repairs defective parts of gear box, rear axle, steering mechanism etc. and sets them right ensuring correct alignment, clearance, meshing of gears, specified movements and operations. Relines and builds brakes, sets wheel alignment, adjust, steering, clutch, hand brakes etc. fits new or repaired accessories and body parts, makes electrical connection, and performs other tasks to effect repairs. Lubricates, joints, tightens loose parts, tests performance of vehicle by driving on road and makes necessary adjustments to attain desired standard. May assemble complete vehicle from finished components.

Maintenance Technician-Service Workshop; maintains and manages tools and equipment used in the workshop.

Auto Service Technician-Mechanic; is responsible for the repair and routine servicing and maintenance (including electrical and mechanical aggregates) of vehicles.

Mechanic Motor Vehicle; repairs overhauls and services motor vehicles to keep them in good running condition.

Fitter Automobile; attends to minor repairs to motor vehicles under guidance of Mechanic Automobile. Receives instructions from Mechanic, Automobile about tasks to attend. Jacks up vehicle to required height for repair in convenient position where necessary. Removes nuts and bolts to dismantle parts such as water pump assembly, fuel pumps assembly, distributor, sparking plugs, starter motors, generator, steering gear, brakes, clutch, transmission and suspension systems, etc. Grinds valve and decarbonizes cylinder head under guidance of mechanic and changes oil of engines and transmission system. Tightens loose parts, lubricates joints, does minor repairs, replacements and adjustments and performs simple fitting operations such as filing, chipping, grinding etc. May work in workshops or garage. May drive vehicle on road. May be designated as Service Mechanic if engaged in cleaning, polishing, oiling and greasing vehicles and do minor routine adjustments as included in servicing.

Motor Vehicle Mechanics, Other; performs number of routine and low skilled tasks in repairing and overhauling motor vehicles such as removing mudguards, bonnets etc. to facilitate working, adjusting alternator and fan belt, assist in bleeding of brakes, draining gear box and oil pump, removing and resetting road spring, etc., and are designated as Motor Mechanic Helper, or Garage Boy according to nature of work done.

Reference NCO-2015:

i. 7231.0100 – Mechanic, Automobile
ii. 7231.0101 – Maintenance Technician – Service Workshop
iii. 7231.0107 – Auto Service Technician – Mechanic
iv. 7231.0400 – Fitter Automobile
v. 7231.9900 – Motor Vehicle Mechanics, Other

Reference NOS:

I. ASC/N9566
II. ASC/N9590
III. ASC/N9565
IV. ASC/N9567
V. ASC/N9403
VI. ASC/N9404
VII. ASC/N9408
VIII. ASC/N9406
IX. ASC/N9402
X. ASC/N9570
XI. ASC/N9407
XII. ASC/N9436
XIII. ASC/N9571
XIV. CSC/N9401
XV. CSC/N9402
XVI. ASC/N9572
XVII. ASC/N9437
XVIII. ASC/N9573
XIX. ASC/N9568
XX. ASC/N9574
XXI. ASC/N9435
XXII. ASC/N9560
XXIII. ASC/N9575
XXIV. ASC/N9440

4. GENERAL INFORMATION

Name of the Trade	**Mechanic Motor Vehicle**
Trade Code	DGT/1008
NCO - 2015	7231.0100, 7231.0101, 7231.0107, 7231.0400, 7231.9900
NOS Covered	ASC/N9566, ASC/N9590, ASC/N9565, ASC/N9567, ASC/N9403, ASC/N9404, ASC/N9408, ASC/N9406, ASC/N9402, ASC/N9570, ASC/N9407, ASC/N9436, ASC/N9571, CSC/N9401, CSC/N9402, ASC/N9572, ASC/N9437, ASC/N9573, ASC/N9568, ASC/N9574, ASC/N9435, ASC/N9560, ASC/N9575, ASC/N9440
NSQF Level	Level : 4
Duration of Craftsmen Training	Two Years
Entry Qualification	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector 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 Students)	24 (There is no separate provision of supernumerary seats)
Space Norms	210 Sq. m (Including Parking)
Power Norms	4.8 KW
Instructors Qualification for	
1. Mechanic Motor Vehicle Trade	B.Voc/Degree in Automobile/ Mechanical Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience** in Automobile/ Mechanical Engineering field. **OR** 03 years Diploma in Automobile/ Mechanical Engineering from AICTE recognized board of technical education with **two years of teaching or industry experience** in Automobile/ Mechanical Engineering field. **OR** NTC/NAC passed in the trade of "Mechanic Motor Vehicle" with **three years of teaching or industry experience** in Automobile field.

	Essential Qualification: Regular/RPL variants of National Craft Instructor Certificate (NCIC) in Automobile Trade under DGT. **Must Possess valid HMV driving License.** ***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.*
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience.** **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education with **two years of teaching or industry experience.** **OR** NTC/ NAC in any one of the engineering trades **with three years of teaching or industry experience.** **Essential Qualification:** Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience.** **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with **two years' of teaching or industry experience.** **OR** NTC/ NAC in any one of the engineering/ Draughtsman group of trades with **three years' of teaching or industry experience.** **Essential Qualification:** Regular/ RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with **Two years' of teaching or industry experience with short term ToT Course** in Employability Skills conducted by DGT institutions. (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 conducted by DGT institutions.
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.

5.1 LEARNING OUTCOMES

Sl. No.	NOS CODE	Learning Outcome	Duration		
			Practical	Theory	Total
FIRST YEAR					
1.	ASC/N9566	Check & perform Measuring & marking by using various Measuring & Marking tools (Vernier Calliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure guage Surface plate, Magnetic stand, V-block. Plastigauge following safety precautions.	120	30	150
2.	ASC/N9590	Plan & perform basic fastening & fitting operation by using correct hand/Power tools, Machine tools & equipment.	90	15	105
3.	ASC/N9565	Test various electrical/ electronic components using proper measuring instruments and compare the data using standard parameters.	145	35	180
4.	ASC/N9567	Check & Interpret Vehicle Specification data and VIN and Select & operate various Service Station Equipment.	25	05	30
5.	ASC/N9403	Removal of Engine from vehicle, Disassemble, inspection & Reassemble of Engine to the vehicle (LMV/HMV) along with other accessories as per SOP.	50	10	60
6.	ASC/N9404	Overhaul Engine and check functionality.	175	35	210
7.	ASC/N9408	Trace, Inspect, Test & Repair Cooling and Lubrication System of engine.	50	10	60
8.	ASC/N9406	Trace, inspect & Test Intake and Exhaust system & auxiliary emission control of engine.	50	10	60
9.	ASC/N9402	Service Fuel System and check proper functionality.	50	10	60
10.	ASC/N9570	Test Engine Performance as per Standards.	50	10	60
11.	ASC/N9407	Monitor Vehicle emission as per compliant norms	25	05	30
12.	ASC/N9436	Overhauling of Alternator and Starter Motor.	25	5	30

13.	ASC/N9571	Diagnose & rectify the defects in LMV/HMV to ensure functionality of vehicle.	25	5	30
14.	CSC/N9401	Read and apply engineering drawing for different application in the field of work.		30	30
15.	CSC/N9402	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.		30	30
		Employability Skills		**120**	**120**
		Total	**840**	**360**	**1200**
		SECOND YEAR			
16.	ASC/N9572	Plan & perform maintenance, diagnosis and servicing of transmission system.	190	50	240
17.	ASC/N9437	Perform maintenance, diagnosis and servicing of Vehicle Control System.	255	60	315
18.	ASC/N9573	Plan & service Electronic Control Unit and check functionality.	50	10	60
19.	ASC/N9568	Diagnose & rectify the defects in vehicle to ensure functionality of vehicle.	20	10	30
20.	ASC/N9574	Carryout overhauling of charging system.	50	10	60
21.	ASC/N9574	Carryout overhauling of starting system.	35	10	45
22.	ASC/N9565	Troubleshoot electrical components of vehicle and ascertain repair.	85	20	95
23.	ASC/N9435	Overhaul, service and testing Vehicle Air Conditioning system, its parts and check functionality.	35	10	45
24.	ASC/N9560	Drive the LMV vehicle by following Traffic Rules and Regulations	50	10	60
25.	ASC/N9575	Identify the inbuilt advanced safety features and check its functionality like PCS (Pre-Collision System), DRCC (Dynamic radar cruise control system), LDA\LTA (Lane Departure alert\Lane Tracing Alert), AHB (Automatic high beam).	20	10	30
26.	ASC/N9440	Identify and study of Electric Vehicle components and Performance comparison of EVs and IC engine vehicles. (Components of Electric Vehicle such as Motor, Motor Controller, Battery Pack, Battery	50	10	60

		Management System, Charging System etc.)			
27.	CSC/N9401	Read and apply engineering drawing for different application in the field of work.		45	45
28.	CSC/N9402	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.		45	45
Employability Skills				**60**	**60**
Total			**840**	**360**	**1200**
Grand Total			**1680**	**720**	**2400**

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Check & perform Measuring & marking by using various Measuring & Marking tools (Vernier Calliper, Micrometer, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure guage Surface plate, Magnetic stand, V-block. Plastigauge) following safety precautions. (NOS: ASC/N9566)	• Plan the working principles of measuring instruments and special tools required for auto workshop. • Select, care and use of measuring instrument. • Set up the measured value with workshop manual and quality concepts and proper safety. • Carry out decision on whether to replace or not. • Role of V-block & holding clamps. • Role of plastic gauge in measuring.
2. Plan & perform basic fastening & fitting operation by using correct hand/Power tools, Machine tools & equipment. (NOS: ASC/N9590)	• Describe the purpose, use of auto hand tools. • List the safety rules for hand tools. • Select the correct tool for the job. • Set up the tacked pieces in specific position. • Joint components by brazing, soldering, riveting as per given drawing. • Produce components by different operation (Drilling, Reaming, Taping, Dieting)
3. Test various electrical/ electronic components using proper measuring instruments and compare the data using standard parameters. (NOS: ASC/N9565)	• Plan and prepare as per procedure and safety methods of soldering the cable ends using an electric soldering iron. • Use crimping tool to make a circuit joint. • Explain the connection of an ammeter, voltmeter, and ohmmeter in a circuit trouble shooting. • State open & short circuit, series and parallel circuits. • Verify DC series & parallel circuits and its characteristics. • Check out the open and short circuits in the lighting circuits. • Verify ohm's law and measure resistance using rheostat. • Check the voltage drop in the auto electrical system by using multimeter.

	• Trace the auto electrical components by using vehicle wiring circuits. • Check the condition of the solenoid switch in the starting system. • Determine the forward to reverse resistance ratio of diodes and identify good / bad diodes. • Perform battery charging.
4. Check & Interpret Vehicle Specification data & VIN and Select & operate various Service Station Equipments. (NOS: ASC/N9567)	• Identify of different type of vehicle. • Identify the different vehicle specification data and information. • Demonstrate the garage, service station different equipment.
5. Removal of Engine from vehicle, Disassemble, inspection & Reassemble of Engine from vehicle (LMV/HMV) along with other accessories as per SOP. (NOS: ASC/N9403)	• Demonstrate safe handling of lifting equipments. • Identify the problems in the vehicle. • Perform the periodic testing of lifting equipment. • Judge whether this Engine needs overhaul or not. • Perform dispose the used engine oil and safety measures in disposal ISO standards & rule of disposal material. • Perform on vehicle Engine Tests to analyze need of Overall. • Perform sequencing and identifying parts at the time of dismantle and assemble.
6. Overhaul Engine and check functionality. (NOS: ASC/N9404)	• Remove accessories fitted to the engine prior to engine removal. • Align the left hook of the crane with engine lifting bracket. • Remove the engine mountings. • Remove the engine from vehicle. • Mount the engine on the vehicle. • Align and fit the gear box to the engine. • Refit the accessories to the engine. • Set the Timing of the Engine. • Overhaul Valve Actuating Mechanism (Hydraulic latch actuator).
7. Trace, Inspect, Test & Repair	• Overhauling of radiator/ recovery tank water pump, oil

Cooling and Lubrication System of engine. (NOS: ASC/N9408)	pump, air cleaner. • Check the engine oil pressure at different r.p.ms. • Overhaul the oil pump. • Set checking & top up coolant, draining & refilling coolant. • Testing cooling system pressure & Thermostat. • Cleaning & reverse flushing, overhauling water pump and refitting and repairs to oil flow pipe lines and unions if necessary. • Check proper functioning of radiator fan (Mechanical/ Electrical / viscous / belt drive).
8. Trace, inspect & Test Intake and Exhaust system & auxiliary emission control of engine. (NOS: ASC/N9406)	• Overhauling of manifolds, silencer and tail pipe, air compressor, air exhauster and inspect parts of air exhauster, turbo charger from vehicle. • Overhauling of air filter, clean & refit air cooler, fuel filter assembly and replace filter elements. • Remove and replace EGR valve, Use Smoke meter to test emission from engine. Use updated as per govt. law
9. Service Fuel System and check proper functionality. (NOS: ASC/N9402)	• Overhauling fuel feed pump, fuel injector pump. • Test injectors, check the injection timing by the spill cut off method.
10. Test Engine Performance as per Standards. (NOS: ASC/N9570)	• Start engine, adjust idling speed. • Overhaul the Governor (Mechanical & Pneumatic). • Set the Engine Timing. • Check performance of engine off load. • Servicing of the cylinder and replace the defective parts.
11. Monitor Vehicle emission as per compliant norms (NOS: ASC/N9407)	• Check vacuum pump for its functioning. • Perform troubleshooting of EVAP Canister. • Inspect PCV hose, inspect PCV Valve and check for vacuum. • Clean the PCV valve and replace if required. • Inspect & clean EGR.
12. Overhauling of Alternator and Starter Motor.	• Trace the circuit from the alternator to the battery. • Perform servicing of starter motor.

(NOS: ASC/N9436)	• Perform servicing of alternator and test its performance. • Check belt condition and replace as per requirement.
13. Diagnose & rectify the defects in LMV/HMV to ensure functionality of vehicle. (NOS: ASC/N9571)	• Plan and diagnose the problem if engine not starting. • Diagnose high fuel consumption and engine overheating. • Diagnose for excessive oil consumption and low/high engine oil pressure. • Diagnose for abnormal engine noise. • Diagnose for engine's poor performance.
14. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/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.
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	• Solve different mathematical problems • Explain concept of basic science related to the field of study
SECOND YEAR	
16. Plan & perform maintenance, diagnosis and servicing of transmission system. (NOS: ASC/N9572)	• Select and wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities. • Work in compliance with standard safety norms. • Carry out their removal and replacement activities by reviewing: vehicle technical data, removal and replacement procedure, legal requirements • Use technical information to support the overhauling of light vehicle/Heavy Vehicle transmission units. • Select tools and materials for the job and make this available for use in a timely manner.

	• Use the tools and equipment in the way specified by manufacturers to overhaul light vehicle/Heavy vehicle transmission unit. • Ascertain the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul. • Conduct appropriate and target oriented discussions with higher authority and within the team, where an overhaul is uneconomic or unsatisfactory to perform. • Perform all overhauling of light vehicle transmission units, adhering to the specifications and tolerances for the vehicle and following: a. Manufacturer's approved overhauling methods b. Standard repair methods c. health and safety requirements. d. workplace procedures • Range: a. Gear box b. Single plate clutch assembly c. Diaphragm clutch assembly d. Constant mesh Gear box e. Synchromesh gear box f. Gear linkages g. Propeller shaft h. Universal Slip Joint i. Rear axle assembly j. Differential assembly • Use testing methods that comply with the manufacturer's requirements. • Adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements.
17. Perform maintenance, diagnosis and servicing of Vehicle Control System. (NOS: ASC/N9437)	• Select and wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities. • Work in compliance with standard safety norms. • Use technical information to support the overhauling of light vehicle/Heavy Vehicle steering and suspension system.

	• Carryout their removal and replacement activities by reviewing: Vehicle technical data Removal and replacement procedures Legal requirements • Use the tools and equipment in the way specified by manufacturers to overhaul steering, suspension and braking system. • Ascertain the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul. • Perform all overhauling of light vehicle Chassis units, adhering to the specifications and tolerances for the vehicle and following: • The manufacturer's approved overhauling methods • Standard repair methods • Health and safety requirements. • Workplace procedures • Range: Shackle Leaf spring Front axle Front and rear suspension Steering Gearbox- worm and roller type Steering Gearbox- Reticulating ball type Master cylinder Tandem Master cylinder Front and rear brake Wheel cylinder Vacuum booster Air servo unit Air tank (reservoir) Brake valve Hand/parking brake Single brake chamber Slack adjuster Disc brake • Manual Rack & Pinion steering overhauling.

	• Hydraulic power steering overhauling. • Power steering pump overhauling. • Usage of SST (Special Service Tool). • Carry out wheel balancing to within acceptable limits. • Carryout the recommended trouble shooting procedure as per Workshop manual for a) Abnormal wear b) Wheel wobbling c) Poor self-centering d) Hard steering. • Rectify the defects following the vehicle manufacture standard procedure. • Use testing methods that comply with the manufacturer's requirements. • Adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements. • Ensure replaced driveline units and assemblies conform to the vehicle operating specification and any legal requirements. • Manual & advance level of wheel alignment.
18. Plan & service Electronic Control System and check functionality. (NOS: ASC/N9573)	• Identify the MPFI components by its name and Locate the MPFI Components in the given engine. • 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. • Connect the scan tool to the Data link connector of given engine. • Read the Error code. • Test the reference voltage and continuity of the circuit as per vehicle wiring circuit. • Repair/Replace the defective part or wiring. • Erase the error memory. • Start and check the engine.
19. Diagnose & rectify the defects	• Ascertain and select tools and materials for the job and

in vehicle to ensure functionality of vehicle. (NOS: ASC/N9568)	make this available for use in a timely manner. • Plan work in compliance with standard safety norms. • Troubleshoot the Engine for Engine Crank but will not start. • Check Ignition Timing of Engine. • Check the function of Mal Indication Lamp (MIL), Oil pressure warning light, charge indication light, temperature warning light/gauge, seat belt warning light, ABS warning light, parking light, fuel level gauge. • Test the various sensors fitted on the given engine using multi meter/scan tool.
20. Carryout overhauling of charging system. (NOS: ASC/N9574)	• 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.
21. Carryout overhauling of starting system. (NOS: ASC/N9574)	• 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.
22. Troubleshoot electrical components of vehicle and ascertain repair. (NOS: ASC/N9565)	• 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. • Carryout the diagnostic procedure for the following troubles in the electrical accessories: • No horn, poor horn, continuous horn. • Wiper and washer no operation, continuous operation, Intermittent operation. • Power window no operation. • Power Door lock no operation. • Immobilizer system and keyless entry no operation. • Trouble (Error indication) in Automatic seat belt system.

	• Trouble (Error indication) in Air bag system
23. Overhaul, service and testing Vehicle Air Conditioning system, its parts and check functionality. (NOS: ASC/N9435)	• 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. • Carryout the diagnostic procedure for the following troubles: • No cooling • Intermittent cooling • Insufficient cooling • Abnormal noise from compressor, magnetic clutch, condenser, evaporator and blower motor • High pressure gauge-pressure High and low • Low pressure gauge-pressure High and low • Different refrigerant used in vehicle. • Properties of refrigerant. • Effect of refrigerant to the environment.
24. Drive the LMV vehicle by following Traffic Rules and Regulations. (NOS: ASC/N9560)	• Follow the road safety measures, traffic rules and statutory regulations. • Demonstrate straight driving. • Demonstrate driving through lanes and curves. • Demonstrate reverse driving. • Demonstrate overtaking of another vehicle. • Demonstrate driving through sand and wet surface. • Learn & understand different traffic sign board. • Demonstrate parking and diagonal parking.
25. Identify the inbuilt advanced safety features and check its functionality like PCS (Pre-Collision System), DRCC (Dynamic radar cruise control system), LDA\LTA (Lane Departure alert\Lane Tracing Alert), AHB (Automatic high beam). (NOS: ASC/N9575)	• Identify the inbuilt advanced safety features. • Perform checks in the inbuilt advanced safety features. • Check functionality like PCS, DRCC, LDA\LTA, AHB.

26. Identify and study of Electric vehicle components and Performance comparison of EVs and IC engine vehicles. (Components of Electric Vehicle such as Motor, Motor Controller, Battery Pack, Battery Management System, Charging System etc.) (NOS: ASC/N9440)	• Interpret Indian vehicle Market Data. • Identify different types of Electric Vehicle Technology (BEV, HEV, • PHEV and FCEV), Architecture of Electric Vehicle. • Identify main components of electric vehicle and their function • Verify component specification sheet. • Trace the High Voltage wiring on the vehicle. • Effect of ICE vehicle to the environment & the solution by EVS. • Etiquette of charging station. • Challenge of EV in Indian scenario. • Compare performance of EV and IC engine vehicles.
27. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/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.
28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	• Solve different mathematical problems • Explain concept of basic science related to the field of study

SYLLABUS - MECHANIC MOTOR VEHICLE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 120 Hrs.; Professional Knowledge 30 Hrs.	1. Check & perform measuring & marking by using various measuring & marking tools (vernier calliper, micrometer, telescope gauges, dial bore gauges, dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure guage, surface plate, Magnetic stand, V-block. Plastigauge) following safety precautions.	1. Familiarisation with institute, job opportunities in the automobile sector, machinery used in trade. types of work done by the students in the shop floor. 2. Practice operation of different workshop equipment. 3. Demonstrate optimum resource management like electricity, water, raw materials, consumables etc at ITIs	**Admission & introduction to the trade:** - Introduction of Automobile, evolution of automotive. - Automotive bodies, like ARAI, NCAP, BS Norms, SIAM etc. - 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 Importance of 5S and ten principles of workmanship, waste segregations, at workshop. **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. - Electrical safety tips. - Introduction to road safety and Automotive emissions.
		4. Practice using all marking aids, like steel rule with spring callipers, dividers, scriber, punches, chisel, surface plate, magnetic stand, V-block, plastic gauge, vernier height gauge and angle plate etc., bore dial gauge, digital measuring instruments 5. Layout a work piece- for line, circle, arcs and circles. 6. Practice to remove wheel lug nuts with use of an air impact wrench. 7. Practice on general workshop tools & power tools. 8. Practice of battery impact wrench & charging method. 9. Knowledge about nut runner linked to conveyor (Fool proof system).	**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. Callipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch**,** centre 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, Circlips 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.
		10. Cam lift measurement 11. Carryout measuring practice on camshaft journal dia, crankshaft journal dia, valve stem dia, piston diameter, and piston pin dia with outside micrometres. 12. Carryout 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. 13. Carryout measuring practice on valve spring free length. 14. Carryout measuring practice on cylinder bore for taper and ovality with dial bore gauges. 15. Perform measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. 16. Inspect cylinder block, cylinder head, manifold	**Systems of measurement** - Description, care & use of Micrometres- Outside and depth micrometer, Micrometer adjustments, Vernier callipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge. - Role of V-block & holding method. - Role of plastigauge measuring. - Measuring wrappage of Intake & Exhaust side of the cylinder head. - Measuring a Piston ring side gap.

		for warpage with straightedge used with a feeler gauge. 17. Perform measuring practice to check the end gap, groove clearance of a piston ring, piston-to-cylinder wall clearance with feeler gauge. 18. Practice to check engine manifold vacuum with vacuum gauge.	
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	2. Plan & perform basic fastening & fitting operation by using correct hand/power tools, machine tools & equipment.	19. Practice on marking and drilling clear and blind holes, sharpening of twist drills safety precautions to be observed while using a drilling machine. 20. Practice on tapping a clear and blind hole, selection of tape drill size, use of lubrication, use of stud extractor. 21. Practice cutting threads on a bolt/ stud, adjustment of two-piece die, reaming a hole/ bush to suit the given pin/ shaft, scraping a given machined surface.	**Material and metal, Drilling machine** - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits. **Taps and die/s:** - 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.
Professional Skill 145 Hrs.; Professional Knowledge	3. Test various electrical/ electronic components using proper measuring	22. Practice in joining wires using soldering iron, construction of simple electrical circuits, measuring of current, voltage and resistance	**Basic electricity** - Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter,

35 Hrs.	instruments and compare the data using standard parameters.	using digital/ analog multimeter/, practice continuity test for fuses, jumper wires, fusible links, and circuit breakers.	ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings.
		23. Diagnose series, parallel, series-parallel circuits, check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, use of service manual wiring diagram for troubleshooting.	- Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.
		24. Carryout cleaning and topping up of a lead acid battery, testing battery with hydrometer. 25. Measuring a specific gravity, freezing point through Refractometer. 26. Connect battery to a charger for battery charging, inspecting & testing a battery after charging, measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit. 27. Test diode for functionality. 28. Perform battery load test	- Description of Chemical effects, Batteries & cells, Lead acid batteries & Sealed 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. **Basic electronics**: - Description of Semiconductors, Solid state devices- Diodes,

		and cranking voltage	Transistors, SoC, SoS. Battery health check-up. Decoding battery numbers as per industry standards.
		29. Identify hydraulic and pneumatic components used in vehicle. 30. Trace hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. 31. Identify components in air brake systems.	**Introduction to Hydraulics & Pneumatics: -** - Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear Pump-Internal & External, single acting, double acting & Double ended cylinder; Pressure relief valve, non-return valve, Flow control valve used in automobile. - Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator).
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	4. Check & Interpret Vehicle Specification data and VIN and Select & operate various Service Station Equipments.	32. Carryout identification of different type of vehicle. 33. Perform demonstration of vehicle specification data 34. Perform identification of vehicle information number (VIN). 35. Demonstrate Garage, Service station equipment - vehicle hoists – two post and four post hoists, engine hoists, jacks, stands.	**Definition: -** - Abbreviation used in Automotive Sector and terminologies like-VVT, VTVT, CRDI, D4D, DCT, CVT, IVT, AMT, ABS, etc. 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. Different Automotive System, like, Engine, Control system, Transmission System, electrical systems etc. - Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands. - Explain about secondary support.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	5. Removal of Engine from vehicle, Disassemble, inspection & Reassemble of Engine to the vehicle (LMV/HMV) along with other accessories as per SOP.	36. Identify parts in a diesel engine of LMV/ HMV. 37. Identify parts in a petrol engine of LMV/ HMV. 38. Practice on starting and stopping of engines. 39. Observe and report the reading of analog /digital tachometer, odometer, temp and fuel gauge under ideal and on load condition. 40. Practice identification of difference in components of Petrol and Diesel Engines. 41. Practice on dismantling engine of LMV/HMV as per procedure.	**Introduction to Engine:** - Description of internal & external combustion engines, Classification of IC engines, Principle & working of 4- stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine (SI), differentiate between stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, 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 Diesel Engine - Procedure for dismantling of diesel engine from a vehicle. **Petrol Engine Basics:** - 4-stroke spark-ignition engines- Basic 4-stroke principles. Spark-ignition engine components- Basic engine components, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components. - Intake & exhaust systems -Electronic fuel injection systems, Exhaust systems. - Intake system components, Air cleaners, Carburettor air cleaners, EFI air cleaners, Intake manifolds, Intake air heating. - **Gasoline Fuel Systems:** Description of Gasoline fuel, Gasoline fuel characteristics, Controlling fuel burn, Stoichiometric ratio, Air density, Fuel supply system, Pressure &

			vacuum.
Professional Skill 175 Hrs.; Professional Knowledge 35 Hrs.	6. Overhaul Engine and check functionality.	42. Overhauling of cylinder head assembly, use of service manual for clearance and other parameters, practice on removing rocker arm assembly manifolds. 43. Perform checking valve seats & valve guide – replacing the valve, if necessary, check valve overlap. testing leaks of valve seats for leakage – dismantle rocker shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble. 44. Check valve springs, tappets, push rods, tappet screws and valve stem cap. 45. Reassemble valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments.	- Criteria for Engine overhauling Engine Components: - Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Petrol and Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence **Valves & Valve Trains** - Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, and Valve seats inserts in cylinder heads, Valve stem oil seals, size of Intake valves, Valve trains, Valve- timing diagram, concept of Variable valve timing. Description of Camshafts & drives, Description of Overhead camshaft, importance of Cam lobes, Timing belts & chains, Timing belts & tensioners.
		46. Practice overhauling piston and connecting rod assembly. 47. Use of service manual for clearance and other	- Description & functions of different types of pistons, piston rings and piston pins and materials. Used recommended clearances

		parameters 48. Practice on removing oil sump and oil pump – clean the sump. 49. Practice on removing the big end bearing, connecting rod with the piston. 50. Practice on removing the piston rings; dismantle the piston and connecting rod, check the side clearance of piston rings in the piston groove & lands for wear, check piston skirt and crown for damage and scuffing, clean oil holes. 51. Measure the piston ring close gap in the cylinder, clearance between the piston and the liner, clearance between crank pin and the connecting rod big end bearing. 52. Check connecting rod for bend and twist. 53. Assemble piston and connecting rod assembly.	for the rings and its necessity precautions while fitting rings, common troubles and remedy. Compression ratio. - Description & function of connecting rod, importance of big- end split obliquely, Materials used for connecting rods big end & main bearings. Shells piston pins and locking methods of piston pins.
		54. Carryout overhauling of crankshaft by referring service manual for clearance and other parameters with crankshaft alignment gauge (manual gauge or IR or laser). 55. Practice on removing	- Description and function of Crank shaft, camshaft, Engine bearings- classification and location – materials used & composition of bearing materials- Shell bearing and their advantages- special bearings material

		damper pulley, timing gear/timing chain, flywheel, main bearing caps, bearing shells and crankshaft from engine checking oil retainer and thrust surfaces for wear. 56. Measure crank shaft journal for wear, taper and ovality, checking crankshaft for fillet radii, bend & twist.	for diesel engine application bearing failure & its causes-care & maintenance. Crank-shaft balancing, Firing order of the engine.
		57. Perform checking of flywheel and mounting flanges, spigot, bearing. 58. Check vibration damper for defects, practice on removing cam shaft from engine block, check for bend & twist of camshaft. 59. Perform inspection of cam lobe, camshaft journals and bearings and measure cam lobe lift. 60. Practice fixing bearing inserts in cylinder block & cap check nip and spread clearance & oil holes & locating lugs fix crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and check seating and refit.	- Description and function of the fly wheel and vibration damper. Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel.
		61. Practice cleaning and checking of cylinder blocks.	- Description of Cylinder block, Cylinder block construction, and

		62. Check cylinder blocks surface flatness visually. 63. Measure cylinder bore for taper & ovality, bore diameter and stroke, clean oil gallery passage and oil pipe line, bore - descale water passages.	Different type of Cylinder sleeves (liner).
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	7. Trace, inspect, test & repair cooling and lubrication system of engine.	64. Practice on checking & top up coolant, 65. Drain & refill coolant, checking / replacing a coolant hose, testing cooling system pressure, practice on removing & replacing radiator/ thermostat. 66. Inspect the radiator pressure cap, testing of thermostat. 67. Perform cleaning & reverse flushing. 68. Carryout inspection of water pump and replace/refit. 69. Practice on checking engine oil, draining engine oil, replacing oil filter, refilling engine oil. 70. Inspect oil pump, oil coolers, and inspect oil pressure relief valves, repairs to oil flow pipe lines and unions and replace if necessary.	- Need for Cooling systems, Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems, Basic cooling system components- Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch. - Need for lubrication system, Functions of oil, Viscosity and its grade as per SAE, Oil, API, additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Corrosion/noise reduction in the lubrication system. Lubrication system components - Description and function of Sump, Oil

			collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	8. Trace, inspect & test intake and exhaust system & auxiliary emission control of engine.	71. Check the intake systems like filter, manifolds etc 72. Inspect turbocharger/ supercharger and replace if necessary. 73. Inspect, clean and refit intercooler. 74. Check exhaust system rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage. 75. Practice on exhaust manifold removal and installation. 76. Practice on catalytic converter removal and installation.	**Intake system components-** - Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material, **Exhaust system components-** - Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers- Reactive, absorptive, Combination., Catalytic converters, Flexible connections, Ceramic coatings, Back-pressure, electronic mufflers.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	9. Service fuel system and check proper functionality.	77. Practice testing of CRDI components and replacement if necessary. 78. Check delivery from fuel Pump, replacing a fuel filter. 79. Bleed air from the fuel lines, servicing primary & secondary filters. 80. Remove a fuel injection pump from an engine-	**Diesel Fuel Systems**- - History of Diesel fuel injection Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology & Clean diesel technology. - Diesel fuel system components – Description and function of Diesel

		refit the pump to the engine - fill lubricating-oil start and adjust slow speed of the engine. 81. Check resistance of injector and calibrate 82. Practice testing of MPFI/GDI/ PGMFI components and replacement if necessary. 83. Check delivery from fuel Pump, replacing a fuel filter.	tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, - Electronic Diesel control- Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines. **Petrol Fuel Systems-** - History of petrol fuel system Description and function of Petrol fuel injection, fuel characteristics, - Petrol fuel system components – Description and function of Petrol tanks & lines, Petrol filters, - Understand Multipoint fuel injection (MPFI), Gasoline direct injection (GDI), PGMFI, Turbo charger fuel stratified injection (TFSI)
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	10. Test engine performance as per standards.	84. Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per workshop manual of the engine. 85. Perform engine component assembly procedures- testing	- **Engine assembly** procedure with aid of special tools and gauges used for engine assembling.

		cylinder compression, checking idle speed, removing & replacing a cam belt, inspecting & adjusting an engine drive belt, replacing an engine drive belt. 86. Test performance of engine with off load adjusting timings. 87. Check performance for misfiring cylinder by isolating defective injectors and test-dismantle and replace defective parts and reassemble and refit back to the engine	
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	11. Monitor vehicle emission as per compliant norms.	88. Practice monitoring emissions procedures by use of engine gas analyser or diesel smoke meter. 89. Checking & cleaning a positive crank case ventilation (PCV) valve. 90. Perform inspection of EVAP canister purge system by use of scan tool. 91. Perform EGR valve removal and installation for inspection. 92. Check SCR after exhaust treatment system for proper functioning.	**Emission Control: - Vehicle emissions** - Standards- Euro and Bharat II, III, IV, V Sources of emission, Combustion, Combustion chamber design. CAFÉ (Corporate average fuel economy) norms **Types of emissions**: - Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels Description of Evaporation emission control, Catalytic

			conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, Controlling air-fuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic Reduction (SCR), EGR VS SCR
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	12. Overhauling of alternator and starter motor.	93. Practice on removing alternator from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of alternator & fitting to vehicles. 94. Practice on removing starter motor vehicle and overhauling the starter motor, testing of starter motor	- Description of charging circuit operation of alternators, regulator unit, ignition warning lamp- troubles and remedy in charging system. - Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	13. Diagnose & rectify the defects in LMV/HMV to ensure functionality of vehicle.	95. Practice on troubleshooting in LMV/HMV for Engine Not starting – mechanical & electrical causes, high fuel consumption, engine overheating, low power generation, excessive oil consumption, low/high engine oil pressure, check engine for noise, vibration and harshness (NVH)	**Troubleshooting:** - Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.
ENGINEERING DRAWING			
Professional	14. Read and apply	**Introduction to Engineering Drawing and Drawing**	

Knowledge ED- 30 Hrs.	engineering drawing for different application in the field of work.	**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 arrow head Leader line with text Position of dimensioning (Unidirectional, Aligned) **Symbolic representation** – Different symbols used in the related trades. **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** of related trades
WORKSHOP CALCULATION & SCIENCE		
Professional Knowledge WCS- 30 Hrs.	15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic	**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, subtraction, multiplication &division Decimal fractions - Addition, subtraction, multiplication& division Solving problems by using calculator (4 hrs) **Square root, Ratio and Proportions, Percentage** Square and square root Simple problems using calculator

	science in the field of study.	Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage - Changing percentage to decimal and fraction **Material Science** Types metals, types of ferrous and non-ferrous metals Physical and mechanical properties of metals Introduction of iron and cast iron Difference between iron & steel, alloy steel and carbon steel Properties and uses of rubber, timber 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 Potential energy, kinetic energy and related problems with assignment **Heat & Temperature and Pressure** Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Thermal conductivity and insulators Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure **Basic Electricity** Introduction and uses of electricity, 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 Magnetic induction, self and mutual inductance and EMF generation **Mensuration** Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder **Levers and Simple machines** Lever & Simple machines - Lever and its types
Project Work/ Industrial Visit: - **Broad Area:**		

a) Testing of engine after assembling.
b) Intake and Exhaust System.
c) Emission control
d) Charging system
e) Vehicle Troubleshooting

SYLLABUS FOR MECHANIC MOTOR VEHICLE TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 190 Hrs.; Professional Knowledge 50 Hrs.	16. Plan & perform maintenance, diagnosis and servicing of transmission system.	96. Identify different major aggregates of Heavy vehicle and their function for various vehicle manufacturers 97. Practice on adjusting clutch pedal play- removing gearbox and clutch assembly from light & heavy vehicle. 98. Perform dismantling clutch assembly, cleaning inspecting parts. 99. Carryout removing & fitting of new pilot bearing, removing & fitting of ring gear in fly wheel, relining a clutch plate, checking condition of flywheel and pressure plate surface for reconditioning. 100. Perform assembling of pressure plate adjusting the fingers, checking run out of fly wheel and aligning clutch assembly with flywheel. 101. Perform dismantling cleaning and assembling of gearshift mechanism	**Introduction:** - Study of different major components & assemblies of heavy vehicle, and different make (indigenous). Name plate-constructional differences and their merits. leading manufacturers in Heavy vehicle Industry **Clutches & Manual Transmissions**- - Clutch principles, Single-plate clutches, multi-plate clutches, Dual mass flywheels, Operating mechanisms, clutch plate types. Clutch components- Pressure plate, Driven/ centre plate, Throw-out bearing, fluid coupling. - Manual transmissions- Gear ratios, Compound gear trains, Gear selection, Bearings, Oil seals & gaskets, Brief about different types of manual transmissions like Automated Manual

		changing oil in gear box. 102. Practice dismantling a synchromesh gear box, cleaning, inspecting parts replacing worn out defective parts assembling & testing for correct performance identifying noises from gear boxes and rectifying.	Transmission (AMT), IMT, CVT, etc **Gearbox layout & operation-** - Gearbox layouts, Transaxle designs, Gearbox operation, Torque converter, Baulk-ring synchromesh unit, Transaxle synchromesh unit. Gear shift mechanism. - Knowledge about DCT (Dual clutch transmission). - Sliding mesh - Constant mesh
		103. Practice on removing open type propeller shaft from vehicle, practice on removing universal joints, cleaning replacing worn out parts, re-assembling & refitting to vehicle- and their alignment, including front wheel drive and all-wheel drive of LMV. 104. Practice on FWD driveshaft removal and replacement. 105. Practice on overhauling & inspection of rear axle. 106. Practice on overhauling & inspection of differential assembly. 107. Perform trouble shooting – causes and remedy for clutch slip, clutch noise, clutch binding, hard	**Final Drive & Drive Shafts** - Basic layouts - Front-wheel drive layout, Rear-wheel drive layout, Four-wheel drive layout, All-wheel drive layout, 4WD v/s AWD - Front-wheel drive, Front-wheel drive shafts, Front-wheel final drives, Front-wheel differentials Rear-wheel drive- Propeller shaft, Type of Universal joints, Type of Constant velocity Joints, Rear-wheel final drives, Salisbury axles, Rear-wheel drive differentials, Limited slip differentials. - Four-wheel drive- Four-wheel drive shafts, Four-wheel final drive, Four-

		clutch, gearbox noise, gear slip, rear axle noise, propeller shaft noise, universal joint noise, differential noise.	wheel drive transfer case, Freewheeling hubs, Four-wheel drive differentials All-wheel drive- four-wheel final drives, All-wheel drive transfer case, Transfer case differential action. - Final gear reduction drive.
		108. Identify automatic transmission components 109. Check automatic transmission fluid and replace transmission fluid & filter. 110. Practice on oil pressure control cable play adjustments, inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler, drive by wire (DBW)	**Automatic Transmissions** - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches. - Planetary gearing- Planetary gears, Simple planetary gear sets, Compound planetary gear sets, Automatic transmission brake bands, multi-disc clutches, electronic control transmission - Electronic control Unit, fully hydraulically controlled transmission, electronic shift programs, Manual selection. - Layout & operation for R, N & D (First & Second) Selector positions, Planetary gear set, High

			range power flow, Low range power flow Servos & clutches-Rear servo, Front servo, One way clutch, multi-plate front clutch, Clutch pack, Rear clutch. - Hydraulic system & controls-Hydraulic system components, Spool valves, Regulating or flow control valves, Control valves, Orifices Valve types & functions-Basic valve action, Regulator & control valves, Shift & governor valves Pressure regulation- The primary regulating valve, Line pressure variation, Modulator valve pressure, the governor, Governor pressure, Kick down pressure. - Flow control- Gear position 1, 1-2 shift valve, 2-3 shift valve assembly, The servo orifice control valve, 3-2 kick down Continuously variable transmission (C.V.T.) - Continuously variable transmission, Drive or reverse, The steel belt, Secondary pulley shaft.
Professional Skill 255	17. Perform maintenance,	**Following practical to be practiced on light & heavy**	**Steering Systems: -** Description and function of

Hrs.; Professional Knowledge 60 Hrs.	diagnosis and servicing of Vehicle Control System.	**vehicle:** 111. Practice on removing the drop arm, check and adjust the turning angle, align the drop arm and steering wheel with the front wheel, check and correct toe-in. 112. Practice on removing steering wheel, steering gearbox. 113. Inspect and overhaul steering boxes, adjusting steering gear backlash, pre-load and, perform wheel alignment (toe-out, adjust toe-in, camber angle, castor angle, kingpin inclination and wheel balancing (run out) 114. Check & top up power steering fluid, 115. Carryout pressure testing a power steering system, flushing a power steering system, 116. Inspect electronic power steering with scan tool. 117. Carryout inspecting & adjusting an engine drive belt 118. Carryout servicing a steering system 119. Practice servicing/ replacing wheel bearings. 120. Perform troubleshooting-causes and remedy for	Steering systems, Principles of steering, Rack-and-pinion steering system, Recirculation ball & nut steering system, Four-wheel steering systems, collapsible steering system. Steering boxes & columns - Description and function of Steering columns, Rack-and-pinion gearbox, Helix, Variable ratio steering, Worm gearbox, Power Assisted steering, Steering process, Flow-control valve, Electric power assisted steering, Basic electric power steering operation Steering arms & components- Forward control vehicle steering, Steering linkages, Joints, Bushes/bushings. **Wheel alignment fundamentals:** Basic principles of wheel alignment, wheel base, wheel track, king pin inclination, Caster, Camber, Scrub radius, Toe-in & toe out, Toe-out on turns, turning radius, Thrust angle & centrelines. - Overhauling of Rack & pinion, Manual steering & Power steering.

		abnormal wear of tyre, wheel wobbling, poor self-centring, hard steering, and vehicle pulling to one side.	
		Following practical to be practiced on light & heavy vehicle: 121. Practice on visual Inspection of chassis frame for crack, bent and twists. 122. Carryout overhauling and inspection of shackle, leaf spring, front & rear suspension. 123. Practice on removing, inspection and assembling of shock absorber 124. Practice lubricating a suspension system. 125. Perform trouble shooting for suspension system defects: wheel hop, ride height (unequal and low), noises under operation, fluid leakage, excessive travel, bounce, worn dampers, worn joints/damaged linkages, vehicle “crabbing”.	**Suspension Systems: -** - Principles of suspension, Suspension force, Upsprung weight, Wheel unit location, Dampening. Types of suspension-Suspension systems, Solid axle, Dead axle, Description, function and advantages of non-independent suspension independent suspension, Rear independent suspension, Rear-wheel drive independent suspension, electronically controlled air suspension (ECAS), Adaptive air suspension operation. Types of springs - Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs. Shock absorber types-Description and function of Hydraulic shock absorbers, Gas-pressurized shock absorbers, Load-adjustable shock absorbers, Manual

			adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load-adjustable shock absorbers Front suspension types & components- Mc person Strut suspension, Short/long arm suspension, Torsion bar suspension Rear suspension types & components-Rigid axle leaf spring suspension, Rigid axle coil spring suspension, independent type suspension, Rigid non-drive suspension.
		126. Practice on removing wheels from light & Heavy vehicle, dismantling tyres and tubes checking puncture and repair of tubed tyre. 127. Practice tubeless tyre puncture repair using puncture repair kit/puncture kit. 128. Practice assembling & inflating tyres to correct pressure. 129. Check & adjust tire pressure by use of air or by Nitrogen 130. Rotate the wheels in vehicle. Minor repairs to wheels and tyres, wheel	**Wheels & Tyres-** - Wheel types & sizes Wheels, Rim sizes & designations, Types of wheels. - Nomenclature of tyres for LMV and HMV. - Tyre types & characteristics- Tyres, Radial ply tyres, Radial ply tyre sidewalls, Tyre pressure monitoring systems, run flat tyres, Low Rolling Resistance (EV), Space-saver tyres, Tyre distortion, Types of tyre wear and causes, - Tyre construction-Tyre construction, Types of

		balancing & alignment. 131. Check for tyre wear patterns.	tyre construction, Tyre materials, Hysteresis, Tyre sizes & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction. Descriptions Tire wear Patterns and causes - Nitrogen v/s atmospheric air in tyres - Introduction to Intermediate Tyre Pressure Monitoring System, Tyre Pressure Monitoring System
		132. Practice on Adjusting brake pedal play, Overhauling and inspection of tandem master cylinder assembly. 133. Perform overhauling and inspection of front and rear brake assembly, overhauling and inspection of wheel cylinder assembly. 134. Bleed hydraulic brakes & disk brakes. 135. Carryout overhauling and inspection of vacuum assisted brake assembly. 136. Perform overhauling and inspection of disc brake. 137. Practice adjusting air brakes- repair to tank	**Braking Systems: -** - Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake pad, Regenerative braking. - **Braking systems -** Brake type - principles, Air brakes, Exhaust brakes, Electric brakes, Parking brakes, Engine brakes, Regenerative braking - Braking system components-Park brake system, Brake pedal, Brake lines, Brake fluid-types, Bleeding, Master cylinder, Divided systems, Tandem master

		unit, air compressor, wheel brake adjuster, brake chamber, pneumatic solenoids, slack adjuster- locating air leaks in the brake lines and rectifying – general maintenance and care. 138. Perform brakes service procedures-checking & adjusting brake fluid, replacing brake fluid, checking brake pads, replacing brake pads, removing & replacing a rotor, replacing brake linings, Adjusting a parking brake cable. 139. Carryout trouble tracing in braking system of a heavy vehicle adjusting all wheel brakes, precautions to be observed while testing brakes points to be remember while preparing the vehicle for brake certificate.	cylinder, Power booster or brake unit, Hydraulic brake booster, Electro hydraulic braking (EHB), Applying brakes, Brake force, Brake light switch - Drum brakes & components -Drum brake system, Drum brake operation, Brake linings & shoes, Back plate, Wheel cylinders - Disc brakes & components -Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake callipers, proportioning valves, Proportioning valve operation, Brake friction materials. Electronic Parking Brake function. - Antilock braking system & components-ABS brake system, Antilock braking system operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit. Electronic Stability programme. - The construction and operation of heavy vehicle Anti-Slip Regulation / Traction

			Control (ASR) system. - Introduction to Electromagnetic retarder brake (EMR) and Engine exhaust brake. Vehicle Stability Control (VSC), Break Assist (BA), Uphill Assist, Downhill Assist.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	18. Plan & service Electronic Control Unit and check functionality.	140. Carryout identification of electronic control unit. 141. Perform identification of various sensors installed in engine & it's mounting. 142. Check instruments & gauges on dash board& replace defective gauges. 143. Test temperature sensor, pressure senor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor.	- **Introduction to EFI Engine Management** - EFI operation Modes of EFI, Electronic fuel injection, Idle speed control systems, Feedback & looping, Cold start systems, Air measurement, Air-flow monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram - Electronic control unit (ECU) - EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp. - Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes. - EFI sensors- 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.
Professional Skill 20 Hrs.; Professional Knowledge 10 Hrs.	19. Diagnose & rectify the defects in vehicle to ensure functionality of vehicle.	144. Carryout diagnosis-possible causes and remedy for engine cranks, but will not or hard to start, poor fuel economy or engine performance. 145. Practice checking ignition timing, checking & changing a spark plug, identification and testing of hall effect sensor, optical sensor, resistive type sensors, tracing and testing of sensor circuits.	- Ignition principles and Faraday's laws, Primary and secondary winding of transformer, Ignition components, Spark plugs, Spark plug components, Vacuum & centrifugal units, Plug firing voltage, - 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.
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	20. Carryout overhauling of charging system.	146. Check charging system for the cause of undercharge, No charge, and over charge conditions. 147. Perform removing & replacing an alternator, inspection of rotor for ground, open circuit – field coil resistance, slip ring surface, fan, bearing. inspection of stator for ground, open circuit, inspection of drive end bearing rotation,	- 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

		Rectifier, brush length compares with service manual. Slip ring surface. 148. Practice inspecting & adjusting an engine drive belt, replacing an engine drive belt/ pulleys / tensioner and their alignments. 149. Carryout Trouble shooting, possible causes and remedy for warning lamp does not glow when ignition switch is on, warning lamp glows dim when ignition switch is on, warning lamp 'on' while the alternator is running, warning lamp glows 'dim' while the alternator is running, warning lamp flickers considerably.	end frames, slip ring & brush assembly, rectifier assembly, alternator cooling fan.
Professional Skill 35 Hrs.; Professional Knowledge 10 Hrs.	21. Carryout overhauling of starting system.	150. Tracing of starter motor circuit. 151. Remove starter motor from vehicle, and carryout performance test for pull-in test, hold-in test, pinion (plunger) return test, no-load performance test. 152. Perform trouble shooting, possible causes and remedy for starter motor not running, starting motor running but too slow (small	- Starting system- purpose of starting system, Staring system components, Starter motor principles, study of starter control circuits. - Starter motor construction, Starter magnet types, Starter motor engagement, Commutation, Switching, solenoid construction.

		torque), staring motor running, but not cranking engine, noise, starting motor does not stop running, growler testing for rotors. 153. Check a starting system, Jump-start a vehicle.	
Professional Skill 85 Hrs.; Professional Knowledge 20 Hrs.	22. Troubleshoot electrical components of vehicle and ascertain repair.	154. Trace the light circuit - test bulbs, align head lamps, aiming headlights. changing a headlight bulb, checking of a head light switch and to replace if faulty. 155. Check head light relay. 156. Perform trouble shooting and remedy for turn signal and hazard warning lights -flash rate high or one side only flashes, no flashing, flash rate low. 157. Perform trouble shooting and remedy for clearance, tail and license plate lights - all lights do not light up, some lights do not light up. 158. Perform trouble shooting and remedy for fuel meter and fuel gauge unit - fuel meter shows no operation or incorrect operation. 159. Perform trouble shooting and remedy for Engine coolant Temp (ECT)	- Lighting system, Lamps/light bulbs, Lamp/light bulb information, LED lighting, Headlights-description of standard sealed beam, halogen sealed beam, composite and High intensity discharge (HID) headlights. Headlight & dimmer circuits, Park & tail light circuits, Brake light circuits, turn signal circuit, Cornering lights, Fog lights circuit, interior lights- courtesy, reading and instrument panel lights, Smart lighting, Reverse lights.

		meter and ECT sensor – engine coolant temp meter shows no operation or incorrect operation. 160. Perform trouble shooting and remedy for oil pressure light – oil pressure warning light does not light up when ignition switch is on at engine off. 161. Perform trouble shooting and remedy for brake and parking brake warning light- brake warning light does not light up when fluid flow level, brake warning light does not light up when parking brake pull up, brake warning lights stay on. 162. Perform trouble shooting and remedy for interior light- Interior light do not light up. 163. Perform trace the wiring circuit of traffic signal flashers light circuit- tracing defects in the flasher circuits, replacing fuse bulb.	
		164. Perform trouble shooting and remedy for horn- no horn operation, poor sound quality, horn sounds continuously and	- **Accessories:** Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door

		to replace the horn if faulty, check horn relay 165. Remove and install wiper motors and wiper switches. 166. Check & replace wiper blades, check wiper relay 167. Perform trouble shooting and remedy for windshield wiper and washer - no operation, intermittent operation, continuous operation, and wipers will not park. 168. Diagnose causes for improper operation of the windshield washer system and to replace the pump if faulty. 169. Diagnose the power window system for – all power window motors do not operate; some switches do not operate. 170. Diagnose the power door lock control for – all power door locks do not operate, only one power door lock not operate. 171. Diagnose for remote keyless entry and immobilizer system. 172. Removing and refitting of Infotainment/multimedia system.	lock circuit, remote keyless entry system circuit, antitheft system, immobilizer system. Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre-tensioners, Tire pressure monitoring systems Integrated communications, Proximity sensors, Introduction to Hybrid & Electronic vehicle, Hydrogen fuel cell vehicle.
Professional Skill 35 Hrs.;	23. Overhaul, service and testing Vehicle	173. Identify Air conditioning components, performance test on A/c	- Heating Ventilation Air Conditioning (HVAC) legislation, Vehicle

Professional Knowledge 10 Hrs.	Air Conditioning system, its parts and check functionality.	unit 174. Check charged state of refrigerant, inspecting & adjusting an engine drive belt, replacing an engine drive belt. 175. Perform Refrigerant recovery –evacuating – charging of A/c system. 176. Replenish compressor oil level. 177. Troubles diagnose and remedy for no cooling or warm air, cool air comes out only intermittently, insufficient cooling, 178. Check abnormal noise from compressor, magnetic clutch, condenser, evaporator, blower motor. 179. Carryout diagnosis test for high pressure gauge – pressure high and low, low-pressure gauge for pressure high and low.	heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, Effect of CFC to the environment. - Properties of 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.
Professional Skill 50 Hrs.;	24. Drive the LMV vehicle by following Traffic	**Driving Practice:** 180. Practice in straight driving on wide roads.	- Traffic rules, Signals & controls. Locating vehicle information.

Professional Knowledge 10 Hrs.	Rules and Regulations	181. Driving through lanes and curves. 182. Practice in reversing. 183. Practice overtaking another vehicle. 184. Practice in driving through sand and wet surfaces. Practice in parking and Diagonal parking. 185. Driving practice on slopes (only for eligible trainees)	
Professional Skill 20 Hrs.; Professional Knowledge 10 Hrs.	25. Identify the inbuilt advanced safety features and check its functionality like PCS (Pre-Collision System), DRCC (Dynamic radar cruise control system), LDA\LTA (Lane Departure alert\Lane Tracing Alert), AHB (Automatic high beam).	186. Check functionality like PCS (Pre-Collision System), DRCC (Dynamic radar cruise control system), LDA\LTA (Lane Departure alert\Lane Tracing Alert), AHB (Automatic high beam). (In OJT)	- Outline of ADAS I &II- PCS (Pre-Collision System), DRCC (Dynamic radar cruise control system), LDA\LTA (Lane Departure alert\Lane Tracing Alert), AHB (Automatic high beam).
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	26. Identify and study of Electric vehicle components and Performance comparison of EVs and IC engine vehicles.	187. Identification and study of basic components of EV 188. Identify and test various gauges/instrument on dashboard of an electric vehicle and identify differences in instrumentation panel	- Introduction to Electric Vehicle Technology, its need, safety precautions needed for servicing of EV vehicles. EV Terminology Comparison of Electric Vehicle with IC engine vehicle based on emissions, range, fuel

	(Components of Electric Vehicle such as Motor, Motor Controller, Battery Pack, Battery Management System, Charging System etc.)	with IC engine vehicle. 189. Identify and test different types of batteries, diodes and transistors	type. Types of electric vehicle, BEV, HEV, PHEV and FCEV. - Architecture of Electric Vehicle, working principle of fully electric vehicle, Major component, performance parameter, Basics of Motors, Selection, sizing and characteristic of Motor, calculation for motor effort, electric transmission. - Principle, working and operation of propulsion system, DC Motor - Drives Armature Voltage, chopper circuit, step-up, Step-down chopper, control strategy, chopper amplifier. - Brushless DC Motor – principle working, features, speed control system of brushless DC motor, efficiency, calculation. - Battery management system - Design of battery pack - Overview of HV battery. - Understand Cell, Module, Busbar. - Role of PCU (Power Control Unit). - Power train of

			Electric/HEV vehicle. - Effect of EV on environment. - Charging station and their etiquette. - Basic motor power calculation.
Engineering Drawing			
Professional Knowledge ED- 45 Hrs.	27. Read and apply engineering drawing for different application in the field of work.	Reading of Electrical, Electronic & Mechanical Sign and Symbols used in Automobile. Sketches of Electrical, Electronic & Mechanical components used in Automobile. Reading of Electrical wiring diagram and Layout diagram used in Automobile Drawing of Electrical circuit diagram used in Automobile. Drawing of Block diagram of Instruments & equipment of trades	
Workshop Calculation & Science			
Professional Knowledge WCS- 45 Hrs.	28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Friction** Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction Friction - Lubrication Friction - Co- efficient of friction, application and effects of friction in workshop practice **Centre of Gravity** Centre of gravity - Centre of gravity and its practical application **Area of cut out regular surfaces and area of irregular surfaces** Area of cut out regular surfaces - circle, segment and sector of circle Related problems of area of cut out regular surfaces - circle, segment and sector of circle **Elasticity** Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress **Heat Treatment** Heat treatment and advantages	

		Estimation and Costing Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing
Project Work/ Industrial Visit: - **Broad Area:** a) MPFI and CRDI b) Engine scanning c) Starting system d) Lighting system e) HVAC f) Electrical accessories		

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs. for 1st year + 60 Hrs. for 2nd year)

Learning outcomes, assessment criteria, syllabus and Tool List of Employability Skills is provided separately in www.cstaricalcutta.gov.in / www.bharatskills.gov.in / www.dgt.gov.in

LIST OF TOOLS AND EQUIPMENT			
MECHANIC MOTOR VEHICLE (for Batch of 24 Candidates)			
S No.	**Name of the Tools & Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Allen Key set of 12 pieces	2mm to 14mm	6+1 nos.
2.	Calliper inside with spring	15 cm	6+1 nos.
3.	Callipers outside with spring	15 cm	6+1 nos.
4.	Centre Punch.	10 mm. Dia. x 100 mm	6+1 nos.
5.	Dividers with spring	15 cm	6+1 nos.
6.	Electrician Screw Driver	250mm	6+1 nos.
7.	Hammer ball peen with handle	0.5 kg	6+1 nos.
8.	Hands file for Second cut flat	20 cm.	6+1 nos.
9.	Star head Screw Driver set of 5 pieces	100 mm to 300 mm	6+1 nos.
10.	Pliers combination	20 cm.	6+1 nos.
11.	Screw driver Blade	20cm.X 9mm.	6+1 nos.
12.	Screw driver Blade	30 cm. X 9 mm.	6+1 nos.
13.	Scriber	15 cm	6+1 nos.
14.	Spanner D.E. set of 12 pieces	6mm to 32mm	6+1 nos.
15.	Spanner, ring set of 12	6 to 32 mm. (metric)	6+1 nos.
16.	Spanners socket with speed handle, T-bar, ratchet and universal set of 28 pieces with box	up to 32 mm	6+1 nos.
17.	Steel rule	30 cm inch and metric	6+1 nos.
18.	Steel tool box with lock and key (folding type)	400x200x150 mm	6+1 nos.
19.	Wire cutter and stripper		6+1 nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
20.	Adjustable spanner (pipe wrench)	350 mm	2 nos.
21.	AC alternator slip ring puller	Variable	1 no.
22.	Air blow gun with standard	Trigger operated with	1 no.

	accessories	interchangeable nozzles	
23.	Ammeter DC with external shunt	300A/ 60A	4 nos.
24.	Air ratchet	with standard accessories	2 nos.
25.	Air impact wrench	with standard accessories.	2 nos.
26.	Anvil with Stand	50 Kgs	1 no.
27.	Battery –charger	Capable to charge batteries from 5AH – 150AH.	2 nos.
28.	Blow Lamp	1 litre	2 nos.
29.	Belt Tensioner gauge		1 no.
30.	Car Jet washer	With standard accessories	1 no.
31.	Chain Pulley Block capacity with tripod stand	3 ton	1 no.
32.	Chisel flat	10 cm	4 nos.
33.	Circlip pliers Expanding and contracting	15cm and 20cm	4 each
34.	Cleaning tray	45x30 cm.	4 nos.
35.	Compression testing gauge	suitable for diesel Engine with standard accessories	2 nos.
36.	Cylinder bore gauge capacity	20 to 160 mm	1 no.
37.	Cylinder liner- Dry & wet liner, press fit & slide fit liner		1 each (consumable)
38.	Depth micrometer	0-25mm	1 no.
39.	Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand)		1 no.
40.	Different type of Engine Bearing model	10 Different types on board	1 set
41.	Different type of piston model	5 Different Types on board	1 set
42.	Drift Punch Copper	15 Cm	2 nos.
43.	Drill twist (various sizes)	1.5 mm to 8 mm by 0.5mm	4 nos.
44.	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
45.	Electric testing screw driver		4 nos.
46.	Engineer’s square	Blade size 15 cm	4 nos.
47.	Engineers’ stethoscope		1 no.
48.	Feeler gauge 20 blades (metric)		4 nos.
49.	File flat, bastard	20 cm	4 nos.
50.	File, half round, second cut	20 cm	4 nos.

51.	File, Square second cut	20 cm	4 nos.
52.	File, Square round	30 cm	4 nos.
53.	File, triangular, second cut	15 cm	4 nos.
54.	Files assorted sizes and types including safe edge file (20 No's)		2 each
55.	Flat File, second cut	25 cm	4 nos.
56.	Flat File, bastard	35 cm	4 nos.
57.	Fuel feed pump for Diesel	Hand operated Plunger Type	1 no.
58.	Grease Gun		2 nos.
59.	Grease Gun heavy duty trolley type	10 kg capacity	1 no.
60.	Hacksaw frame	adjustable 20-30 cm	12 nos.
61.	Hammer Ball Peen	0.75 Kg	4 nos.
62.	Hammer Chipping	0.25 Kg	5 nos.
63.	Hammer copper with handle	1 Kg	4 nos.
64.	Hammer Mallet		4 nos.
65.	Hammer Plastic		4 nos.
66.	Hand operated crimping tool/wire	(i) up to 4mm (ii) up to 10mm	2 each
67.	Hollow Punch set of seven pieces	6mm to 15mm	2sets
68.	Insulated Screw driver	20 cm x 9mm blade	4 nos.
69.	Insulated Screw driver	30 cm x 9mm blade	4 nos.
70.	Lifting jack screw	3 ton, 5ton & 20 Ton	1 each
71.	Magneto spanner set with 8 spanners		1set
72.	Magnifying glass	75mm	2 nos.
73.	Multimeter digital	LCD Display	5 nos.
74.	Oil can	0.5/0.25-liter capacity	4 nos.
75.	Automotive oil pump for dismantling and assembling.		2 nos.
76.	Outside micrometer	0 to 25 mm	2 nos.
77.	Outside micrometer	25 to 50 mm	2 nos.
78.	Outside micrometer	50 to 75 mm	1 no.
79.	Outside micrometer	75 to 100 mm	1 no.
80.	Philips Screw Driver set of 5 pieces (pozi drive and torx drive)	100 mm to 300 mm	2 nos.
81.	Piston ring compressor		2 nos.

82.	Piston Ring expander and remover.		2 nos.
83.	Piston Ring groove cleaner.		1 no.
84.	Pliers flat nose	15 cm	2 nos.
85.	Pliers round nose	15 cm	2 nos.
86.	Pliers side cutting	15 cm	2 nos.
87.	Portable electric drill Machine	Up to 10mm (heavy duty)	1 no.
88.	Prick Punch	15 cm	4 nos.
89.	Punch Letter 4mm (Number)		2 sets
90.	Radiator cut section-cross flow	Radiator with sectioned side tanks, radiator core.	1 no.
91.	Radiator cut section-down flow	Radiator with sectioned upper & lower tanks, radiator core and cap.	1 no.
92.	Radiator pressure cap	LMV	2 nos.
93.	Scraper Triangular	25 cm	2 nos.
94.	Scriber	15 cm	2 nos.
95.	Scriber with scribing black universal		2 nos.
96.	Set of stock and dies -Metric		2 sets
97.	Spanner T. for inaccessible area		2 nos.
98.	Spanner, adjustable	15cm	2 nos.
99.	Spark plug spanner 14mm x 18mm x Size	14mm X 18mm	2 nos.
100.	Starter motor axial type, pre-engagement type & Co-axial type		1 each
101.	Steel measuring tape in a case	10 meters	2 nos.
102.	Steel rule 15 cm inch and metric		4 nos.
103.	Straight edge gauge 2 ft.		2 nos.
104.	Stud extractor set of 3		2 sets
105.	Stud remover with socket handle		1 no.
106.	Surface gauge with dial test indicator plunger type	0.01 mm	4 nos.
107.	Tachometer (Counting type)		1 no.
108.	Tandem master cylinder with booster		4 nos.
109.	Thermostat		2 nos.
110.	Thread pitch gauge Metric		2 nos.

111.	Timing light		2 nos.
112.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
113.	Turbocharger cut sectional view	Latest WGT type to show turbine, impeller and compressor wheels.	1 no.
114.	Tyre pressure gauge with holding nipple		2 nos.
115.	Universal puller for removing pulleys, bearings		1 no.
116.	V' Block	75 x 38 mm pair with Clamps	2 nos.
117.	Vacuum gauge	0 to 760 mm of Hg.	2 nos.
118.	Valve Lifter		1 no.
119.	Valve spring compressor universal		1 no.
120.	Vernier calliper	0-300 mm with least count 0.02mm	4 nos.
121.	Vice grip pliers		2 nos.
122.	Automotive Water pump for dismantling and assembling		4 nos.
123.	Wire Gauge (metric)		2 nos.
124.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	4 nos.
125.	Working model of Air Brake Assembly	Two brake drums, vehicular air compressor driven by suitable Electric Motor, air dryer, brake chamber. stop light, different valves, air pressure gauges. With all accessories.	1 no.
126.	Alternator assembly used for LMV	Alternator (>50 Amp)	1 no.
127.	Cut section Model of Mock layout of a motor car –electrical system working model	Wiring with parts and accessories of a car to be arranged according to the electrical circuit of a car. Working of Self-starter, Alternator, Wiper Motor, Horn, lighting system, sparks from plug to be shown with Distributor & battery. Should be mounted on suitable table	1 no.
128.	Cut section models of shock absorbers		1 no.

129.	Cut section of cross ply and radial tyres		1 no.
130.	Cut section working model of automatic transmission Gear box	Sectioned to show the internal mechanism of forward and reverse speeds.	1 no.
131.	Cut section working model of centrifugal clutch assembly.	Centrifugal Clutch sectioned to show the internal details	1 no.
132.	Cut section working model of Diaphragm clutch assembly.	Diaphragm Clutch sectioned to show the internal details	1 no.
133.	Cut section working model of Single plate clutch assembly	Single plate Clutch sectioned to show the internal details	1 no.
134.	Demonstration board of electronic Ignition system, ignition coil	With HT coil, HT wires, Spark Plugs, ignition switch, coil, distributor, battery, and wiring.	1 no.
135.	Demonstration board of MPFI system	With injectors, rail, inlet manifold, throttle body, distributor, ECU, purge valve, sensor, crank pulley, fuel tank module.	1 no.
136.	Disk brake in working condition with caliper assembly with all parts	Exhibiting Brake disc, Caliper assembly, tandem master cylinder, brake hoses, oil bottle, pedal, etc.	1 no.
137.	Drum brake assembly in Working Condition	Brake drum, tandem master cylinder, oil container, brake hose, brake pedal.	1 no.
138.	Front axle (Razeppa Joint) with stand for Dismantling and assembly	Razeppa joint of LMV.	1 no.
139.	Full floating axle and semi-floating axle assembly	Drum & axle casing should be with all components in working condition.	1 no.
140.	Steering assembly – 1.Rack & pinion 2.Worm & roller 3. Recirculating ball 4.Power steering 5. Electric Assisted Power Steering	1. Rack & Pinion with steering wheel, column, tie rod end. 2. Worm & Roller steering assembly with drop arm. 3. Recirculating Ball Steering with pitman shaft and drop Arm. 4. Hydraulic working power steering with steering wheel, column, flow pipe, hydraulic pump, oil reservoir. 5. Electric Assisted Power Steering	1 each

		with Rack and pinion, Electric Motor and Motor Control Module	
141.	Synchronous Gear box with stand for Dismantling and assembly	Gearbox with 5 Forward & 1 Reverse Gear	1 no.
142.	Tandem master cylinder with booster	Working model	1 no.
143.	Tubed tyre of car, trucks & motorcycle		1 each
144.	Tubeless tyre of cars & trucks		1 each
145.	Tyre & split rim wheel assembly		1 no.
146.	Working Model of power windows	Showing parts like door, glass with motor and its gear arrangement and operating switch.	1 no.
147.	Working model of torque converter	Model of LMV	1 no.
GENERAL SHOP OUTFIT			
148.	Air conditioned CRDI Vehicle in running condition -LMV	New vehicle with CRDI engine, 04 strokes, 04 cylinders, BS-VI, fitted with air conditioning.	1 no.
149.	Arbor press hand operated	2-ton capacity	1 no.
150.	Automotive exhaust 5 gas analyser and Diesel Smoke meter (for petrol & Diesel) (Optional)	Exhaust 5 Gas Analyzer Petrol ARAI approved to check CO, CO_2, O_2, and HC& NO. Diesel Smoke Meter ARAI approved.	1 no.
151.	Diesel Engine – CRDI - 4 strokefor Dismantling and Assembling with Swiveling Stand.	Latest 4 Stroke 4-cylinder turbo charged CRDI Engine, 800-1600cc, in running condition, with ECM, BCM (optional), and all sensors, wiring, fuel feed & cooling system & instrument cluster.	1 no.
152.	Diesel engine (Running condition) Stationary type single cylinder	Single Cylinder, OH valves, fuel tank with handle, fuel feed, water cooling, oil pump.	1 no.
153.	Hydraulic jack HI-LIFT type	3-ton capacity, and 5 Ton capacity	1each
154.	Multi Scan Tool To scan Engine, ABS & EBD, AT, SRS, Body Control	Should perform automotive sensor simulation test specially designed to	1 no.

	and immobilizer	diagnose and simulate vehicle sensor faults for sensors like MAP sensor, Intake air temperature sensor, TP sensor etc.	
155.	Spring tension tester	Manually operated with analogue display.	1 no.
156.	Trolley type portable air compressor	Belt driven compressor along with accessories	1 no.
157.	Working Condition of Diesel Engine – CRDI - 4 stroke Engine, Assembly with fault simulation board	Latest 4 Stroke 4-cylinder turbo charged CRDI Engine, with ECM, BCM and sensors, wiring, fuel feed, cooling system & instrument cluster. Fault setting bank with diagnostic socket & Scanner to read the faults. Engine management circuit diagram to be printed on the panel board.	1 no.
158.	Cut section of 4/6 cylinder diesel engine in moving condition to show movement of internal parts	6-cylinder diesel engine in working condition to show movement of internal parts	1 no.
159.	Diesel Engine six Cylinder in running condition	Latest Diesel Engine CRDI 4 Stroke 6 Cylinders, Turbocharged Engine in running condition. All sensors, wiring, fuel feed, cooling system & instrument cluster	1 no.
160.	Air conditioning service Unit (Car)	Suitable for R134A. Recovery with vacuum pump, automatic drain & stop after recovery.	1 no.
161.	Petrol Car with CNG kit	New vehicle with latest emission norms 3/4-cylinder MPFI Engine 800-1600cc	1 no.
162.	Heavy Commercial vehicle	Fitted with Latest 06-cylinder CRDI diesel engine with all parts and accessories. (Without body on frame)	1 no.
163.	MPFI petrol engine with swiveling stand along with special tools for dismantling and assembling	Latest 4 Stroke 3/4-cylinder MPFI Engine in running condition 800-1600cc with ECM, BCM (optional) and all sensors, wiring, fuel feed system, cooling system & instrument cluster.	1 no.

		N.B.: If ECM and BCM are available as one control unit can be purchased instead ECM, BCM as separated.	
164.	Transfer case with stand for Dismantling and assembly.	To show the gear mechanism of forward and reverse speeds.	1 no.
165.	Tube/ tyre vulcanizing machine	220 V, Heater Capacity 400W	1 no.
166.	Two post car lift – capacity 4000 kg	Hydraulic Type with Mechanical Arms Locking.	1 no.
167.	Tyre Changer Machine	Motorized Pneumatic Type, Rim clamping facility, and bead breaking facility with air inflating device.	1 no.
168.	Wheel alignment Machine – computerized 3D (Optional)	Latest machine for four-wheel alignment. With connected camera, IR Lighting Source min. 8mm, Reflector metal based, should work in sunlight	1 no.
169.	Wheel balancing machine	For wheel balancing of LMV. Motor 0.5 HP Shaft Diameter min 38mm. Hardened flange assy. Balancing catch nut of metal.	1 no.
170.	Working Condition of Petrol MPFI Engine Assembly with fault simulation board	Latest 4 Stroke 3/4-cylinder MPFI in running condition,800-1600cc with ECM, BCM and all sensors, wiring, fuel feed system, cooling system & instrument cluster with Fault setting bank for minimum 6 sensors with diagnostic socket & Scanner to read the faults. Engine management circuit diagram to be printed on the panel board.	1 no.
171.	Working Condition E.V (Electric Vehicle)/Hybrid Car	New Electric car with all required accessories including battery charger	1 No
CONSUMABLE			
172.	Battery		As required
173.	Brake fluids		As required
174.	Chalk, Prussian blue		As required
175.	Chemical compound for fasteners		As required
176.	Diesel		As required

177.	Different type gasket material		As required
178.	Different type of oil seal		As required
179.	Drill Twist (assorted)		As required
180.	Emery paper	36–60 grit, 80–120	As required
181.	Engine oil & Engine coolant		As required
182.	Gear oils		As required
183.	Hacksaw blade (consumable)		As required
184.	Holders, lamp teakwood boards, plug sockets,		As required
185.	Hydrometer		5 nos.
186.	Lapping abrasives		As required
187.	Petrol		As required
188.	Power steering oil		As required
189.	Radiator Coolants		As required
190.	Safety glasses		As required
191.	Steel wire Brush	50mmx150mm	5 nos.
192.	Battery for E.V Car		As required
193.	Diodes and transistors		As required
CLASS ROOM FURNITURE FOR TRADE THEORY			
194.	Instructor's table and Chair	Steel	1 set
195.	Students chairs with writing pads		24 nos.
196.	White board size	1200 mm X 900 mm	1 no.
197.	Instructors lap top with latest configuration pre-loaded with operating system and MS Office package.		1 no.
198.	LCD projector/interactive smart board.		1 no.
199.	Trainee's locker	6½ 'x 3' x 1½'	1 set each (optional)
TOOLS & EQUIPMENTS FOR ENGINEERING DRAWING HALL			
200.	Drawing board	(700mm x500 mm) IS: 1444	24 +1 nos.
201.	Mini drafter		24 +1 nos.
202.	Set square	celluloid 45^{o} (250 X 1.5 mm)	24 +1 nos.
203.	Stool for trainees		24 +1 nos.
204.	Cupboard (big)		1 no.
205.	White Board	8ft. x 4ft.	1 no.

206.	Trainer's Table		1 no.
207.	Trainer's Chair		1 no.
208.	Draughtsman drawing instrument box		24 +1 nos.
209.	Draughtsman table		24 +1 nos.

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.

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ANNEXURE – III

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 Apprenticeship 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
E.V	Electric Vehicle


कौशलं बलम्