MECHANIC MOTOR VEHICLE

NSQF LEVEL- 6

SECTOR- AUTOMOTIVE

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

MECHANIC MOTOR VEHICLE

Also Applicable for "Mechanic Auto Electrical & Electronics", "Mechanic Two &Three Wheeler" and "Driver cum Mechanic (LMV)" Trades

(Engineering Trade)

SECTOR –AUTOMOTIVE

(Revised in 2019)
Version 1.1

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Developed By
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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960's by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency-based course for instructors of one-year duration. "Mechanic Motor Vehicle" CITS trade is applicable for Instructors of "Mechanic Motor Vehicle, Mechanic Auto Electrical & Electronics, Mechanic Two &Three Wheeler and Driver cum Mechanic (LMV)" Trades.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 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
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	**Engineering Technology**	
	Workshop Calculation & Science	80
	Engineering Drawing	120
3.	**Training Methodology**	
	TM Practical	320
	TM Theory	200
	Total	**1600**

2.2 PROGRESSION PATHWAYS

- Can join as Instructor in Vocation Training Institute/ Technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment

criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS CRITERIA

Sl. No.	Subject		Marks	Internal assessment	Full Marks	Pass Marks	
						Exam	Internal assessment
1.	Trade Technology	Trade Theory	100	40	140	40	24
2.		Trade Practical	200	60	260	120	36
3.	Engineering Technology	Workshop Cal. & Sc.	50	25	75	20	15
4.		Engineering Drawing	50	25	75	20	15
5.	Training Methodology	TM Practical	200	30	230	120	18
6.		TM Theory	100	20	120	40	12
Total Marks			**700**	**200**	**900**	**360**	**120**

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%.There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***good*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.

(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***high*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**MECHANIC MOTOR VEHICLE-CITS**
Trade Code	DGT/ 4008
NCO – 2015	2356.0100,7231.9900, 7231.0100, 7231.0101, 7231.0107, 7231.0400, 8322.0501, 7231.0500, 7231.0501, 7412.0701
NSQF Level	Level-6
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in appropriate branches of Mechanical / Automobile Engineering from AICTE/ UGC recognized Engineering College / University. OR Diploma in appropriate branches of Mechanical / Automobile Engineering from AICTE/ recognized board / Institution. OR NTC/ NAC passed in **Mechanic Motor Vehicle** or other related trades. AND **Essential:** Valid MCWG & LMV driving License Mandatory for all.
Minimum Age	18 years as on first day of academic session.
Space Norms	120 Sq. m & 240 Sq. m (Parking Area)
Power Norms	6 KW
Instructors Qualification for	
1. Mechanic Motor Vehicle -CITS Trade	B.Voc/Degree in Automobile or Mechanical Engineering from AICTE/UGC recognized University with two years experience in relevant field. OR 03 years Diploma in Automobile or Mechanical from AICTE/recognized Board/ Institution or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field. OR NTC/ NAC in Mechanic Motor Vehicle with seven years of experience in relevant field. **Essential:** Valid MCWG & LMV driving License Mandatory for all. **Essential Qualification**: National Craft Instructor Certificate (NCIC) in **Mechanic Motor Vehicle** trade, in any of the variants under DGT.
2. Workshop Calculation & Science	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of

	technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any Engineering trade with seven years experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT
4. Training Methodology	B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor	21 Years

Distribution of training on Hourly basis: (Indicative only)

Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	TM Practical	TM Theory
40 Hours	16 Hours	6Hours	2 Hours	3 Hours	8 Hours	5 Hours

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools &equipments of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

Mechanic, Motor vehicle; 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 rebored, liners filled, valve seats refaced, bearings replaced etc. as necessary.
Repairs or overhauls and assembles engine such as replacing defective parts, scrapping bearings, setting timing, cleaning injectors, tuning carburetor, MPFI and CRDI Engines 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. Trouble shooting and rectification of engine, chassis, and auxiliary system. State the importance of Motor vehicle act and rules Plan and organize assigned work and detect & resolve issues during execution.
Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

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. 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, micro trend 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, tuning carburetor 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 irresponsible for the repair and routine servicing and maintenance (including electrical and mechanical aggregates) of vehicles.

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, carburetor, 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.

Driver Cum Mechanic (LMV);To drive Light Motor Vehicle safely & efficiently on public & private roads, following all Rule and regulations in force & giving no room for accidents that causing damage to other road users, public & private properties, passengers and goods being carried. Strictly maintaining scheduled times for passengers embarking/disembarking & goods loading /unloading. To collect passenger or goods as per information received from office. Maintain politeness with passengers and follow all the safety/security measures. Calculate appropriate fares communicating/collecting the same from passengers. Calculate the freight costs based goods weight & volumes and the distance and communicate / collect from the consigner. Proper discharge of passenger or goods at the appropriate place as per instruction and time schedules. Communicate & handover the passenger fare / freight amounts with relevant information to office / owner. Always keep statutory documents / records pertaining to self, the vehicle, passengers & goods & to present when demanded by the concerned authorities. Understand & follow the regulation while transporting the Hazardous goods. To know about the vehicle & various system available and use them judiciously. Maintain the vehicle in good working condition, doing pre-checks before starting the vehicle. Plan & carry out timely recommended services by manufacturers. Maintain operating vehicle economically by achieving good KMPL & better tyre life.

Mechanic, Motor Cycle; Repairs, services and overhauls motor cycles, auto rickshaws, scooters; etc., to keep them roadworthy. Examine motor cycle or scooter to locate faults by running engine in stationary position or by driving it on road. Dismantle parts such as engine, ignition system, dynamo forks, shock absorbers, gear box etc., as necessary. Grinds valves, sets timings,

relines brakes, re-bushes steering mechanism, replaces worn out parts, assembles gear box clutch etc. Performs other tasks to affect repair, cleans and sets carburetor, fits driving chain, wheels silencer, kick, gear, clutch and brake levers and other accessories. Adjusts control cables for brake, clutch and accelerator, sets tappets and wheel alignment, tightens loose parts and makes necessary fittings and connections. Changes engine and gear box oil, starts engine and tunes it up. Tests performance of vehicle by driving on road and makes further adjustments to remove defects noticed if any. Assembles motor cycle or auto-rickshaws from previously dismantled parts.

Auto Service Technician; (two and three wheelers); is responsible for the repairing and routine servicing and maintenance (including electrical and mechanical aggregates) of two/three wheeler vehicles.

Electrician, Automobile; installs, repairs replaces and overhauls wiring, starters, generators, distributors and other electrical equipment of motor vehicles. Examines vehicle battery, checks voltage and specific gravity using special equipment such as voltmeter hydrometer, heavy discharge tester, etc. and ensures that battery is in good condition. Checks vehicle wiring, locates faults and rectifies defects by replacing damaged wire or connecting ends with insulation tape. Starts engine to check whether alternator is charging correctly, and if distributor, condenser coil and cut out are functioning properly. Estimates nature of defects and reports components to be replaced or repaired. Dismantles and repairs electrical units and components such as generator, distributor etc. where required. Replaces repaired kit or unit in vehicle and connects it with battery. Conducts thorough examination of various electrical fittings such as lights, panel indicators, fuel pumps, etc. and rectifies defects. Checks condition and makes necessary adjustments. May do armature winding. May drive vehicles on road. May charge batteries.

Reference NCO 2015:

a) 2356.0100 -Manual Training Teacher/Craft Instructor
b) 7231.9900 - Motor Vehicle Mechanics, Other
c) 7231.0100 -Mechanic, Automobile
d) 7231.0101 – Maintenance Technician ,Service Workshop
e) 7231.0107- Auto Service Technician, Mechanic
f) 7231.0400 - Fitter Automobile
g) 8322.0501- Driver Cum Mechanic (LMV)
h) 7231.0500 - Mechanic, Motor Cycle
i) 7231.0501 - Auto Service Technician
j) 7412.0701 - Electrician, Automobile

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 TRADE TECHNOLOGY

1. Explain Quality Management tools- 5S, 7QC etc. & ensure compliance of safety practice and handling of hand tools, special tools and maintenance of them.
2. Analyse diagnosis of problems in various Engine system(viz. Lubrication system, emission control system and control system)and troubleshoot engine.
3. Evaluate maintenance, diagnosis and servicing of fuel supply system in petrol and diesel engines.
4. Evaluate maintenance, diagnosis and troubleshooting of Electrical and Electronics systems.
5. Evaluate driving performance of trainees.
6. Evaluate diagnosis and troubleshooting of Chassis and Body: Suspension system, GPS, Music system, Body related Electric and Electronic system.
7. Analyse diagnosis and troubleshooting of Electric and Electronic related to MPFI and CRDI.
8. Evaluate diagnosis and troubleshooting of CNG, LPG & hybrid system.
9. Examine/interpret the faults in Diagnosis of Transmission system and suggest appropriate measures for: Clutches, Gear boxes, (Mechanical Automatic, Semi Automatic, CVT, Transaxle, and Transfer Case) differential and final drive.
10. Justify appropriate procedures of Diagnosis of Vehicle Control System (Steering: Mechanical, Hydraulic and Electrical steering, steering geometry, wheels& tyres etc).
11. Assess Diagnosis of vehicle Air conditioning system.
12. Evaluate diagnosis of problems and troubleshoot vehicle safety system.

6. COURSE CONTENT

SYLLABUS FOR MECHANIC MOTOR VEHICLE – CITSTRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skill (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 16 Hrs Theory 06 Hrs	Explain Quality Management tools-5S, 7QC etc. & ensure compliance of safety practice and handling of hand tools, special tools and maintenance of them.	1. Practice 5s techniques in the automobile work shop. 2. Precautions to be observed while working in the automobile work shop and garage equipments. 3. Handling & maintenance of hand tools, special tools, equipments& machineries. 4. Maintenance of garage equipments in the workshop. 5. Preventive maintenance of vehicle/engines.	• Admission, introduction, facility available in the institute. • Importance of safety, safety precautions& first aid. • Concept of 5S & 7QC tools, time management as employed for quality circle. Importance of healthy environment. • Application and safety to be observed while handling hand tools, special tools, equipments& machineries. • Importance and types of maintenance of vehicles/engines. • Safely handling of hazardous materials.
Practical 144Hrs Theory 54Hrs	Analyse diagnosis of problems in various Engine system (viz. Lubrication system, emission control system and control system) and troubleshoot engine.	6. Checking engine vacuum & compression pressure. 7. Taking Cylinder leakage test with compressed air. 8. Measure the cubic capacity of a given engine. **Driver cum Mechanic**: 9. Prepare a Maintenance Chart for Performing Daily, Weekly, Monthly and Condition Based Maintenance of Given Vehicle.	• Explanation of Principle of All types of SI and CI Engines with respect to pressure, volume and temperature. • Thermodynamic cycles with respect to pv&ts diagrams. • Valve timing diagram of all types of Engine. • Maintenance:- Importance of Maintenance and its various Types.
		10. Servicing cylinder head assembly. 11. Remove all accessories attached with the engine	• Importance of servicing cylinder head-Precautions to be observed while servicing

		dismantling the head components and its visual inspection- 12. Measuring components for wear with precision measuring instruments-suggestions for remedy and taking remedial measures. Reassembling cylinder head components.	cylinder head. • Reasons for frequently occurring abnormal wear in cylinder head components and its Effects on engine performance. • Constructional details, Advantages and disadvantages of variable valve timing.
		13. Servicing cylinder block assembly. 14. Removing and dismantling piston and connecting rod assembly, crank shaft and flywheel, vibration damper from the engine. 15. Visual inspection of cylinder block for various parameters such as bore, main journal etc. for wear and suggest remedial measures. 16. Visual inspection of the cylinder blocks components (piston and connecting rod assembly, crank shaft, flywheel etc.)	• Importance of servicing cylinder block-Precautions to be observed while servicing cylinder block. • Reason for measuring cylinder block for various parameters to find out its serviceability and suggestions for remedial measures. • Reasons for frequently occurring abnormal wear in cylinder block components and its Effects on engine performance.
		17. Measuring cylinder block & components for wear with precision measuring instruments-suggestions for remedy and taking remedial measures. 18. Reassembling the engine block and its components. 19. Refit cylinder head assembly. 20. Setting valve timing. 21. Checking and setting valve clearance. 22. Practice on checking and setting variable valvetiming.	• Importance of measuring cylinder blocks components for actual wear to decide serviceability. • Engine assembly procedure as recommended by manufacturers. • Importance and correct procedure of setting valve timing • Importance of correct valve clearance Precautions to be observed while assembling engine components.

		23. Maintenance, diagnosis and Servicing intake systems. 24. Servicing of different types of air cleaner, turbocharger, intercooler, throttle body, intake manifold. 25. Maintenance, diagnosis and Servicing exhaust systems. 26. Servicing of exhaust manifold, catalytic converter, resonator, muffler.	• Study about intake system components such as air cleaner, different types of turbo charger, super charger, throttle body, intake manifold etc. Importance of maintenance, diagnosis and Servicing intake systems. • Causes of failure of the components of intake system. • Trouble shooting in an intake system. • Study about exhaust system components such as exhaust manifold, muffler, types of catalytic converter etc. • Importance of maintenance, diagnosis and • Servicing exhaust systems. • Causes of failure of the components of exhaust system. • Trouble shooting in an intake system.
		27. Maintenance, diagnosis and servicing of lubrication system. Changing engine oil and filter. Tracing oil leak from the engine. Overhauling of oil pump, 28. Checking oil pressure relief valves for proper functioning. 29. Servicing oil coolers. 30. Checking oil galleries 31. Oil pressure testing. 32. Removing of sludge by using flushing oil.	**ENGINE LUBRICATION SYSTEM** • Lubricant, types, application and its properties. Study about lubrication systems and its components such as oil sump, oil strainer, oil pump, relief valve, filter, bypass valve, oil cooler etc. • Study about oil filtering systems. • Importance of maintenance, diagnosis and Servicing lubricating system and its components. • Causes of failure of the

			lubricating system and its components. • Importance of testing of oil pumps. • Importance of servicing oil filter. • Importance of checking and setting correct oil pressure. • Reasons for sludge formation and its prevention Trouble shooting in lubricating system and its components.
		33. Maintenance, diagnosis and servicing of cooling system. 34. Flushing cooling system replacing coolant. 35. Tracing coolant leakage from the engine. Checking cooling system for proper functioning. 36. Replacing/Overhauling of water pump. Checking thermostat valve. Adjusting fan belt tension. 37. Checking radiator pressure cap for proper functioning. 38. Replacing/Servicing radiator. 39. Diagnosis of improper operating temperature.	**ENGINE COOLING SYSTEM** • Coolant, types, and its properties. • Importance of maintaining correct coolant-water ratio. • Study about cooling systems and its components such as radiator, pressure cap, types of hoses, types of water pump, electric fan, thermostat, fan belts, temperature gauge, temperature sensor etc. Study about oil filtering systems. Importance of maintenance, diagnosis and Servicing cooling system and its components. Causes of failure of the cooling system and its components. • Importance of testing of pressure cap. • Importance of servicing radiator. • Trouble shooting in cooling system and its components.
		40. Checking of exhaust gas in petrol engine using	**EMISSION CONTROL SYSTEM.** • Definition, Sources of

		exhaust gas analyser. 41. Checking of exhaust gas in diesel engine using Smoke meter. 42. Maintenance of crank case ventilation system. Maintenance of EGR system.	emission (such as Exhaust system, crank case, fuel tank and carburetor). Methods to control emission, (1. exhaust system with EGR OR Air injection system in to exhaust manifold with catalytic converter 2. Positive crank case ventilation. 3. Evaporative control system ie charcoal canister. Vehicle emission standards- Euro and Bharat standards. Emission control.
Practical 32 Hrs Theory 12 Hrs	Evaluate maintenance, diagnosis and servicing of fuel supply system in petrol and diesel engines.	43. Maintenance, diagnosis and servicing of basic petrol fuel system components. 44. Overhauling of fuel tank, mechanical fuel Pump, electrical pump, fuel filters, and carburetors testing of fuel pumps for proper functioning. **Mechanic Two and Three wheelers:** 45. Carburetor Two and Three Wheelers:- Perform removal of carburetor, float, float valve, jet clean, inspect and adjust the float level as per manual and assemble the carburetor.	**FUEL SUPPLY SYSTEM IN PETROL ENGINE** • Gasoline Fuel: properties of Gasoline fuel - combustion processes. • Study about carburetor fuel system and its components such as fuel tank, mechanical fuel Pump, electrical pump, fuel filters, carburetors and its circuits etc. • Importance of maintenance, diagnosis and Servicing carburetor fuel system and its components. • Causes of failure of the carburetor fuel system and its components. • Trouble shooting in carburetor fuel system and its components. • Importance of testing of fuel pumps.
		46. Maintenance, diagnosis and servicing of conventional diesel fuel system and its components. 47. Overhauling of fuel tank, fuel feed Pump, electrical	**FUEL SUPPLY SYSTEM IN DIESEL ENGINES.** • Diesel fuel & its properties - combustion processes. • Study about conventional

		pump, fuel filters, types of fuel injection pumps, governors, injector Testing of fuel feed pumps for proper functioning. 48. Servicing of fuel tanks, Checking leaks in the fuel lines, draining of water separators. Replacing of primary& secondary filters. Phasing and calibration of fuel injection pump. Testing of injectors for its proper functioning. Setting fuel injection timing Bleeding diesel fuel system.	diesel fuel system and its components such as fuel tank, fuel feed Pump, electrical pump, fuel filters, water separators, fuel injection pumps, governors, injectors etc. Importance of maintenance, diagnosis and Servicing diesel fuel system and its components. Causes of failure of the diesel fuel system and its components. • Importance of testing of fuel feed pumps, FIP and injectors. • Importance of setting correct FIP timing. Importance of bleeding the fuel system. Trouble shooting in diesel fuel system and its components.
Practical 80 Hrs Theory 30 Hrs	Evaluate maintenance, diagnosis and troubleshooting of Electrical and Electronics systems.	49. Maintenance, diagnosis and servicing battery. 50. Checking of battery condition using hydrometer and battery tester. 51. Charging batteries in series and parallel. Maintenance of battery. Jump starting a battery. Preparation of electrolyte. Reconditioning of terminal post.	**Battery/accumulator-** • Types, construction, working. • Battery capacity & rating, Booster starting. IBS, Disposal of waste battery. Advantages of slow charging. • Advantages of solidification of electrolyte by adding salicylic acid or introducing absorbed glass mat (AGM)-VRLA battery Electrolyte-definition, percentage of sulphuric acid and water. • Effects of improper ratio of acid and water on battery life. Specific gravity of water, acid and electrolyte. Temperature effect on specific gravity. Battery troubles and their

			remedies.
		52. Maintenance, diagnosis and servicing of starting system 53. Checking starter circuit for proper functioning. Checking solenoid switches for proper functioning 54. Overhauling all types of starter. Checking of starter for proper functioning.	• Study about starting system and its components. Importance of checking starter circuit for proper functioning. • Role of solenoid switch and relay, importance of its checking. • Importance of testing starter components. Troubles and remedies in starting system.
		55. Maintenance, diagnosis and servicing of charging system 56. Checking charging circuit voltage drop test for proper functioning. 57. On vehicle inspection of alternator for proper functioning. 58. Overhauling of alternator Testing voltage regulator. **Mechanic Two & Three Wheelers:** 59. Trace the A.C /D.C electrical circuit in two wheelers and three wheelers.	• Study about Charging system and its components. • Importance of checking charging circuit for proper functioning. • Battery power source, Ignition coil, DC/ACCDI, TCI. • Contact breaker, capacitor/condenser, Distributors. • Distributor types of Two and Three wheelers. • Importance of voltage regulation. • Importance of testing. • Charging system components. • Troubles and remedies in charging system.
		60. Maintenance, diagnosis and servicing of conventional ignition system 61. Checking ignition circuit for proper functioning. 62. Checking magneto coil for proper functioning. Checking magneto for proper strength. Checking and Setting of magneto ignition timing using Ignition Timing light. 63. Overhauling distributor.	• Study about types of conventional Ignition system and its components. • Importance of checking ignition circuit. Importance of checking and setting correct ignition timing. • Study about distributor and its components. Importance of checking distributor for proper functioning.

		64. Checking vacuum & centrifugal advance mechanism for proper functioning. Testing ignition coil, spark plug, condenser for proper functioning using testing equipment. Setting ignition timing. Checking of Ignition timing using Ignition Timing light	• Importance of testing ignition coil, spark plug, condenser for proper functioning. Common troubles in Ignition system.
Practical 16 Hrs Theory 06 Hrs	Evaluate driving performance of trainees.	**Driver cum Mechanic:** 65. Evaluate driving parameters of Simulator. 66. Practice Initial freeway Driving& assess the same. 67. Check Pre – Driving parameters. 68. Practice Driving on Various road as per rule& evaluate the same.	• Introduction to Driving Simulator. • Pre – Driving Checks, After sitting on driver seat, Gauges etc. • Precautions and Procedure to be followed while starting, Proper use of Accelerator, Precautions to be followed while moving. • Motor Vehicle Act, Important definitions and salient features of motor vehicle Act.
Practical 32 Hrs Theory 12 Hrs	Evaluate diagnosis and troubleshooting of Chassis and Body: Suspension system, GPS, Music system, Body related Electric and Electronic system.	69. Trouble tracing in lighting system, Head light alignment. 70. Trouble tracing in digital dashboard gauges. Horn circuit, servicing of horn. Servicing of wiper motor, flasher circuit, Power window, power mirror. Testing body control module(BCM) using **CAN** communication system.	• Lighting system and its accessories:-Function, lay out, working of all circuits. Dazzling of lights. • Lights used in automobiles. • Head lights, LED lights, HID lights, Light circuit and switches Digital panel board gauges and their circuit Power mirror, CAR stereo, Intelligent parking assisting system, Blue tooth and GPS/GPRS assisted navigation system. • Horn and horn relay circuit, Wiper motor and its circuit, Power window and its circuit, Flasher

			unit and its circuits **CAN**BUS (CONTROLLER AREA NETWORK) networking system. (history, definition and advantages) Study about the schematic and routing diagram of BCM.
Practical 80 Hrs Theory 30 Hrs	Analyse diagnosis and troubleshooting of Electric and Electronic related to MPFI and CRDI.	71. Engine petrol diagnostic information and procedures-Engine and emission control system-analyzing the complaint-handling of scan tool-checking freeze frame data-recording freeze frame data and clearance-visual inspection-confirmation of trouble system- rechecking freeze frame data.	• Precautions to be observed while working with engine emission control systems-details of OBD-description of data link connector-study about schematic and routing diagram of emission control system-flow diagram of control systems-terminal arrangement of ECM.
		72. Trouble shooting for DTC(Diagnostic Trouble Code)-checking DTC circuits-identifying the trouble by scan tool-tracing the faults by trouble code-checking intermittent problems-final confirmation 73. Test.	• Details of trouble codes-functions of sensors and actuators-details of scan tool-precautions while working with sensors and actuators.
		74. Identification of various components of MPFI system. 75. Servicing of petrol injector 76. Checking of ECU, for proper functioning. 77. Checking of fuel pump for proper functioning. 78. Checking fuel pressure regulator. Checking various types of sensors.	• Electronic Fuel Injection (EFI) system-Function, types, construction and working of EFI system. Advantages& disadvantages of Throttle body fuel injection system or SPFI &MPFI system, Function, types, construction , working of components of EFI system such as Electronic control unit(ECU),fuel tank, fuel line, fuel pump, fuel filter, fuel rail, fuel pressure regulator, fuel injector, idle air control valve, throttle body, relays, sensors .
		79. Servicing CRDI fuel system:	• Precautions to be

		checking low pressure fuel supply circuit-preliminary check-checking fuel pump operation-checking fuel pressure-checking high pressure fuel supply circuit-checking fuel injector leak-checking fuel regulator.	observed before removing the CRDI fuel system-study about the low and high pressure fuel supply circuits.
		80. Removing a CRDI pump from an engine-refit the pump to the engine. Start and adjust slow speed of the engine. Overhauling of various types of injectors. Testing of various types of injector. Checking and replacing the components of CRDI system.	• Electronic Diesel control-Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. • Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.
Practical 16 Hrs Theory 06 Hrs	Evaluate diagnosis and troubleshooting of CNG, LPG & hybrid system.	81. Find out the location of CNG kit components in vehicle. 82. Overhauling of CNG kit components. (conventional type) 83. Overhauling of CNG kit components. (Gas injection type) 84. Find out the location of LPG kit components in vehicle. 85. Overhauling of LPG kit components. 86. Maintenance, diagnosis and servicing of electric and hybrid car. **Mechanic Two & Three Wheelers:** 87. Repair and maintenance of LPG/CNG kit of three wheelers.	• **ALTERNATIVE FUELS, TYPES,PROPERTIES:** Advantages & disadvantages of each type of fuel. CNG engine and its advantages. CNG conversion kit, function, constructional details.(Conventional type) CNG conversion kit, function, constructional details. • (Gas injection type) L P G engine and its advantages. L P G Conversion kit, function, constructional details. • Comparison between diesel, LPG and CNG. Electric car and Hybrid car.
Practical 48 Hrs Theory 18 Hrs	Examine/interpret the faults in Diagnosis of Transmission system and suggest appropriate measures for:	**Maintenance, diagnosis and servicing of transmission system** 88. Identification of components system and types of drive. 89. Identification of	**TRANSMISSION SYSTEM** • Definition, function, Layout and working of transmission system. Torque tube drive and Hotchkiss drive.

	Clutches, Gear boxes, (Mechanical Automatic, Semi Automatic, CVT, Transaxle, and Transfer Case) differential and final drive.	components of transmission system & its location. **Mechanic Two & Three Wheelers:** 90. Adjustment of clutch pedal play and adjust clutch lever free play. Overhauling of different types of clutch assembly. 91. Overhauling of hydraulic clutch master cylinder &slave cylinder.	• Components of transmission system:- CLUTCH:-Function, types, construction, working of each type such as single plate coil spring & diaphragm spring clutch, multi plate dry & wet clutch, centrifugal clutches, Fluid coupling, Torque converter. • Common troubles and remedies in clutches.
		92. Overhauling of constant mesh gear box. Overhauling of synchromesh gearbox Calculating gear ratio Overhauling of transaxle assembly Overhauling of automatic transmission assembly. **93. Mechanic Two & Three Wheelers:** 94. Inspect and repair Automatic clutch and automatic transmission used in two wheeler and three wheeler.	• GEAR BOX:- Function, types, construction, working of each type such as Sliding mesh, constant mesh, synchromesh, transaxle, Automatic transmission- Planetary gearbox, Dual shift gearbox and CVT (continuously variable transmission)Gear box, fluid fly wheel, torque converter, gear ratios. Troubles, causes and remedies in gear box. Automatic transmission used in two wheeler and three wheeler.
		95. Overhauling of universal joint assembly. Overhauling of different CV joints. Overhauling of rear axle assembly. Dismantling of final drive gears, differential gears, inspecting tooth wear, adjusting back lash, preloading reassembling.	• UNIVERSAL JOINT: - Function, types, construction, working of each type. Types of CV joints. • PROPELLER SHAFT & SLIP JOINT:-Function, types, construction, working. • DIFFERENTIAL AND REAR AXLE:-Function, types. Construction and working. Troubles, causes and remedies in rear wheel drive.
Practical 144Hrs	Justify appropriate procedures of	96. Checking and replacing of bearings, removing of	• FOUR WHEEL DRIVE: - Function, Construction,

Theory 54Hrs	Diagnosis of Vehicle Control System (Steering: Mechanical, Hydraulic and Electrical steering, steering geometry, wheels & tyres etc).	wheel bearings, cleaning, checking, replacing, pre loading, assembling of rear axle and adjusting the wheel bearings) Overhauling transfer case.	and working. Comparison between four wheels and all wheels drive. • TRANSFER CASE: - Function, Construction, and working. Common troubles and remedies in transmission system.
		97. Overhauling of shackle, leaf springs of front rear suspension. 98. Overhauling of macpherson suspension system. 99. Overhauling of coil spring suspension system. 100. Removing and checking of different types of shock absorber.	**SUSPENSION SYSTEM** • Conventional suspension system-Description and function of different types of leaf spring, coil spring, Torsion bar and rubber spring. • Front and rear Independent suspension systems, Air suspension system, Gas pressurized shock absorber. • Comparison of independent and rigid axle suspension system. • Common troubles and remedies in suspension system
		101. Checking of front axle for twist and bend. 102. Removing wheel from light & heavy vehicles. 103. Checking of puncture in tube & tubeless tyres. 104. Checking wheel balance. Tyre rotation.	• Front axle:-Function types, construction, Types of stub axles Wheels & Tyres description, function and types. Run flat tyres. • Types of rim assembly, Ply rating, tyre rotation, Necessity of Inflation pressure, Tyre sizes and designations, tyre retreading, tyre tread patterns and wheel balancing common troubles in wheels & Tyres. TUFFUP tube. • Aspect ratio of tyre, Repair procedure of TUFFUP tube.
		105. Calculating steering gear ratio.	• Steering system-functions, types of

		106. Inspect and adjust the steering wheels with respect to front wheels. **Mechanic Two & Three Wheelers:** 107. Inspect and overhaul different types of manual steering gearboxes, Identify steering system components in two and three wheelers. Practice on handle bar removal, inspection and assembling of handlebar. 108. Perform removal of front fork, inspection of front fork spring, fork tube, piston, slider and assembling of front fork. Practice on steering stem removal, steering stem adjustment.	steering linkages, constructional details of different types of manual steering gearboxes. Function of ball joint, fixed and variable steering gear ratios. • Description of collapsible steering column. Description of different types of steering & handle of Two & Three Wheelers, fork mounted over races.- Description, construction and function of steering stem.
		109. Adjusting steering gear backlash and end play. Check and adjust toe-in, camber, king pin inclination, castor angle and included angle. 110. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system Overhauling of power steering pump and gear box.	• Description and function of Ackerman steering mechanism. • Details of steering geometry Power steering -Hydraulic, electric and electronic and its types. • Importance of Maintenance of steering column and linkages. • Importance of maintenance of power steering gear. Common troubles and remedies in steering system.
		111. Overhauling of front and rear brake assembly. 112. Overhauling of master cylinder& wheel cylinder. 113. Overhauling of disc brake assembly. Adjusting brake pedal free play. Bleeding hydraulic brake system-manual, vacuum and pressure bleeding.	**BRAKE SYSTEM** • Function, types, lay out, working of all brake system. • Components of hydraulic brake system:-function, types, construction and working of master cylinder, wheel cylinder, Drum brake, disc brake, Brake lining, Brake shoe and brake fluid.

			• Parking brake, exhaust brake and retarder. • Minimum stopping distance. Type of bleeding methods.
		114. Overhauling components of power assisted hydraulic brake system. 115. Servicing of vacuum pump mounted in alternator. 116. Adjusting a parking brake cable.	• Components of Air assisted hydraulic brake:- Function, working of all components such as air compressor, air booster, air valve, air tank along with the components of hydraulic brake system. • Components of Vacuum assisted hydraulic brake:- Function, working of all components such as vacuum booster, vacuum valve, vacuum pump/vacuum tank along with the components of hydraulic brake system.
		117. Adjusting Air brakes- repair to tank unit, air compressor, wheel brake adjuster- locating air leaks in the brake lines and rectifying. Servicing all air brake components. Testing brakes with brake testing equipment 118. Balancing all four wheel brakes. precautions to be observed while testing brakes	• Components of failsafe air brake system:- Function, types, construction and working of air brake system such as air compressor, air filter, unloader valve, air tank, brake valve, flick valve, front spring brake chamber, rear spring brake actuator, brake shoe, brake liner, system protection valve and slack adjuster.
		119. Maintenance, diagnosis and servicing of antilock brake system. 120. Diagnosing wheel speed sensor problems.	• Antilock braking system- Principles, operation and components of Antilock braking system, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, Antilock braking system (ABS)with EBD (electronic brake distribution) unit. • Traction control system. Importance of Brake

			testing and common troubles in braking system.
Practical 16 Hrs Theory 06 Hrs	Assess Diagnosis of vehicle Air conditioning system.	121. Checking performance of air conditioning system. 122. Checking charged state of refrigerant. Charging of refrigeration system. Diagnosis abnormal noise and rectifying it.	**Heating, Ventilation and Air Conditioning system** • Basic principles of air conditioning system, components of air conditioning system in motor vehicle description and function. • Types of refrigerants. Common troubles and remedies of air conditioning system.
Practical 16 Hrs Theory 06 Hrs	Evaluate diagnosis of problems and troubleshoot vehicle safety system.	123. Maintenance and diagnosis of supplementary restraint system(SRS) such as Checking of air bags, Crash sensors, seat belt pre-tensioners, Tire pressure monitoring system, Vehicle tracking system, Vehicle security systems, immobilizer system, Central locking system, Car alarms for proper functioning.	**Vehicle safety system** • Description and function of air bags, working principle of air bags, Crash sensors, seat belt pre-tensioners, Tire pressure monitoring system, Vehicle tracking system, Vehicle security systems, immobilizer key, Central locking system, Car alarms.

SYLLABUS FORCORE SKILLS
1. Workshop Calculation & Science(Common for all Engineering CITS trades) (80 Hrs)
2. Engineering Drawing (Group I) (120Hrs)
3. Training Methodology (Common for all trades) (320Hrs + 200Hrs)

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

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY(TT)	
1. Explain Quality Management tools- 5S, 7QC etc. & ensure compliance of safety practice and Handling of Hand tools, special tools and maintenance of them.	Explain 5s & 7QC techniques in the automobile work shop.
	Ensure precautions to be observed while working in the automobile work shop and garage equipments.
	Evaluate handling & maintenance of hand tools, special tools, equipment & machineries.
	Ensure compliance of safety precautions while handling hand tools, special tools, equipment & machineries.
	Evaluate Preventive maintenance of garage equipment in the workshop.
2. Analyse diagnosis of problems in various Engine system (viz. Lubrication system, emission control system and control system) and troubleshoot engine.	Assess planning and executing of dismantling & assembling of Engine from vehicle (LMV/HMV) along with other accessories.
	Evaluate Overhauling of Engine and check functionality.
	Evaluate Tracing, Testing& Repairing of Cooling and Lubrication System of engine, Intake and Exhaust system of engine.
	Assess servicing of different types of air cleaner, turbocharger, intercooler, throttle body and intake manifold.
	Assess servicing of exhaust manifold, catalytic converter, resonator and muffler.
	Check and propose possible optimization and compare their cost effectiveness.
	Contribute to continuous improvement of work process in the related area.
	Evaluate Engine Performance and set idling speed.
	Analyse emission of vehicle and execution of different operation to obtain optimum pollution as per emission norms.
	Monitor, evaluate and document work result.
3. Evaluate maintenance, diagnosis and servicing of fuel supply system in petrol and diesel engines.	Evaluate dismantling & assembling of fuel feed system along with other accessories.
	Evaluate Servicing of Fuel System and check proper functionality.
	Check and propose possible optimization and compare their cost effectiveness.
	Contribute to continuous improvement of work process in the related area.
	Evaluate Engine Performance and set idling speed.

4. Evaluate maintenance, diagnosis and troubleshooting of Electrical and Electronics systems.	Evaluate diagnosis of problems and maintenance of batteries.
	Evaluate Service & repair of charging and starting System components.
	Assess overhauling and assembling of distributor.
	Evaluate Servicing of ignition system, vacuum & centrifugal advance mechanism and check proper functionality.
	Check and propose possible optimization and compare their cost effectiveness.
	Contribute to continuous improvement of work process in the related area.
	Evaluate Performance of serviced units for functionality.
5. Evaluate driving performance of trainees.	Evaluate driving parameters of Simulator.
	Demonstrate Initial freeway Driving & assess the same.
	Evaluate Pre – Driving parameters.
	Demonstrate Driving on various road as per rule & evaluate the same.
6. Evaluate diagnosis and troubleshooting of Chassis and Body: Suspension system, GPS, Music system, Body related Electric and Electronic system.	Evaluate overhauling of vehicle chassis and body units, adhering to the specifications and tolerances for the vehicle as per : a. The manufacturer's approved overhauling methods. b. Standard/ non standard repair methods. c. Health and safety requirements. d. Workplace procedures.
	Evaluate testing of Body Control Module (BCM) using CAN communication system.
	Justify assembling of sub-assemblies and components in a manner appropriate to the location and their functionality.
	Evaluate the proper functional sequence.
	Check and propose possible optimization and compare their cost effectiveness.
	Contribute to continuous improvement of work process in the related area.
	Monitor, evaluate and document work result.
7. Analyse diagnosis and troubleshooting of Electric and Electronic related to MPFI and CRDI.	Evaluate dismantling and assembling of CRDI pump for servicing.
	Plan and execute dismantling & assembling and evaluate servicing of MPFI and CRDI system components.
	Analyse Rectify rectification of the defects following the vehicle manufacture`s standard procedure.
	Select and use testing methods that comply with the manufacturer's requirements.
	Check and propose possible optimization and compare

	their cost effectiveness.
	Evaluate Performance of serviced units for functionality.
	Assess trouble shooting for Diagnostic Trouble Code (DTC) and check DTC circuits.
	Monitor, evaluate and document work result.
8. Evaluate diagnosis and troubleshooting of CNG, LPG & hybrid system.	Evaluate dismantling & assembling of CNG, LPG& hybrid system components.
	Analyse rectification of the defects following the vehicle manufacture`s standard procedure.
	Select and use of testing methods that comply with the manufacturer's requirements.
	Check and propose possible optimization and compare their cost effectiveness.
	Evaluate Performance of serviced units for functionality.
9. Examine/interpret the faults in Diagnosis of Transmission system and suggest appropriate measures for: Clutches, Gear boxes, (Mechanical Automatic, Semi Automatic, CVT, Transaxle, and Transfer Case) differential and final drive.	Evaluate overhauling of vehicle Transmission system units, adhering to the specifications and tolerances for the vehicle as per: a. The manufacturer's approved overhauling methods. b. Standard/ non standard repair methods. c. Health and safety requirements. d. Workplace procedures.
	Justify assembling of sub-assemblies and components in a manner appropriate to the location and their functionality.
	Check the proper functional sequence.
	Check and propose possible optimization and compare their cost effectiveness.
	Contribute to continuous improvement of work process in the related area.
	Monitor, evaluate and document work result.
10. Justify appropriate procedures of Diagnosis of Vehicle Control System (Steering: Mechanical, Hydraulic and Electrical steering, steering geometry, wheels & tyres etc).	Evaluate overhauling, diagnosis and repair of vehicle steering system and suspension units, adhering to the specifications and tolerances for the vehicle as per : a. The manufacturer's approved overhauling methods. b. Standard/ non standard repair methods. c. Health and safety requirements. d. Workplace procedures.
	Assess selection and using of the recommended trouble shooting procedure as per Workshop manual.
	Analyse rectification of the defects following the vehicle manufacture`s standard procedure.
	Select and use of testing methods that comply with the manufacturer's requirements.
	Evaluate the diagnosis of front axle for twist and bend.
	Assess repair of puncture in tube & tubeless tyres,

	wheel balance and tyre rotation.
	Evaluate adjusting of steering gear backlash and end play.
	Assess diagnosis and adjusting of power steering fluid, pressure and flushing.
	Evaluate dismantling and assembling of front & rear brake, master & wheel cylinder, hydraulic brake system and air brakes.
	Evaluate diagnosis and servicing Antilock Brake System (ABS) and wheel speed sensor.
11. Assess Diagnosis of vehicle Air conditioning system.	Ensure causes of malfunctions and errors of vehicle Air conditioning system.
	Evaluate the possibility of the rectification of such malfunction and errors of vehicle Air conditioning system.
	Evaluate servicing of refrigerant system, abnormal noise and air conditioning system.
	Ensure or improve the functionality of the system by controlling and monitoring different parameters of vehicle Air conditioning system.
	Use protective and safety equipments.
12. Evaluate diagnosis of problems and troubleshoot vehicle safety system.	Analyse causes of malfunctions and errors of vehicle safety system.
	Evaluate maintenance and diagnosis Supplementary Restraint System (SRS) like air bags, crash sensors, pre-tensioners etc.
	Assess diagnosis and repair of vehicle safety system.
	Ensure or improve the functionality of the system by controlling and monitoring different parameters of various vehicle safety systems.
	Ensure use of protective and safety equipments.

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR MECHANIC MOTOR VEHICLE (CITS)			
For batch of 25 candidates			
S no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Steel rule	150 mm (graduated both English and metric)	25+1 nos.
2.	Steel rule	300 mm(graduated both English and metric) as per IS 1481	25+1 nos.
3.	Steel measuring tape	10 meter in a case	25+1 nos.
4.	Engineers Try Square	150 mm with knife edge as per IS 2013	25+1 nos.
5.	Outside Caliper	15 cm spring type	25+1 nos.
6.	Inside Caliper	15 cm Spring type	25+1 nos.
7.	Dividers	15 cm Spring type	25+1 nos.
8.	Safety glasses		25+1 nos.
9.	Scriber	15 cm	25+1 nos.
10.	Knife double Blade Electrician		25+1 nos.
11.	Wire insulation Stripper for shinning conductors	from 0.4mm to 4mm	25+1 nos.
12.	Electrician testing Pencil (Line / Neon tester)		25+1 nos.
13.	Electrician Screw Driver	250mm	25+1 nos.
14.	Centre punch	10 cm.	25+1 nos.
15.	Chisel cold flat	20 mm x 150 mm	25+1 nos.
16.	Hammer ball peen	0.5 kg with handle	25+1 nos.
17.	Screw driver	20cm.X 9mm. Blade	25+1 nos.
18.	Screw driver	30 cm. X 9 mm. Blade	25+1 nos.
19.	Spanner D.E. set of 12 pieces	(6mm to 32mm) as per IS2028	25+1 nos.
20.	Combination Pliers	20 cm	25+1 nos.
21.	Side cutting Pliers	15 cm	25+1 nos.

22.	Round nose Pliers	15 cm	25+1 nos.
23.	Flat nose Pliers	15 cm	25+1 nos.
24.	Hand file	20 cm. Second cut flat	25+1 nos.
25.	Hand file	20 cm. Second cut half-round	25+1 nos.
26.	Hand file	20 cm. smooth triangular	25+1 nos.
27.	Hand file	30 cm. bastard	25+1 nos.
28.	Hand file	30 cm. round bastard	25+1 nos.
29.	Ring spanner set of 12 pieces	6mm to 32mm	25+1 nos.
30.	Feeler gauge 20 blades(metric)		25+1 nos.
31.	File card or cleaner		25+1 nos.
32.	Wire cutter and stripper		25+1 nos.
33.	Allen key set of 12 pieces	2mm to 14 mm	25+1 nos.
34.	Steel tool box with lock and key (folding type)	400x200x150 mm	25+1 nos.
35.	Punch Letter	4mm	25+1 nos.
B. INSTRUMENT AND GENERAL SHOP OUTFIT			
36.	Outside micrometer	0 to 25 mm with least count 0.010mm as per IS 2967	2 nos.
37.	Outside micrometer	25 to 50 mm with least count 0.010mm as per IS 2967	2 nos.
38.	Outside micrometer	50 to 75 mm with least count 0.010mm as per IS 2967	2 nos.
39.	Outside micrometer	75 to 100 mm with least count 0.010mm as per IS 2967	2 nos.
40.	Inside micrometer	25-50, 50-75, 75-100, 100-125, 125-150mm, with least count 0.01mm	2 each
41.	Depth micrometer	0-25mm with least count 0.010mm	2 nos.
42.	Thread Micrometer	0-25mm with least count 0.010mm	2 nos.
43.	Adjustable micrometer sprit level to measure flatness, indication and taper with prismatic measuring base		2 nos.
44.	Vernier caliper	200mm inside and outside (graduated in inches and millimeters)	1no.
45.	Digital Vernier calliper outside	300mm least count 0.01mm	2 nos.
46.	Vernier depth Gauge	0-150 mm	2 nos.

47.	Vernier bevel protractor, least count 5minutes	as per IS 4239	2 nos.
48.	Telescope gauge		2 nos.
49.	Dial test indicator plunger type (complete with clamping devices and stand)		4 nos.
50.	Universal Surface gauge		2 nos.
51.	Cylinder bore gauge	capacity 20 to 160 mm	2 nos.
52.	Compression testing gauge suitable for petrol engine.		2 nos.
53.	Vacuum gauge to read	0 to 760 mm of Hg.	2 nos.
54.	Granite surface plate	Grade 0,630 x 630 x 100 mm with adjustable stand as per IS7327	1 no.
55.	Calipers	15 cm Hermaphrodite	2 nos.
56.	Chisels cross cut	200 mm X 6mm	2 nos.
57.	Chisel	10 cm flat	2 nos.
58.	Ball Peen Hammer	0.75 Kg	2 nos.
59.	Hammer Mallet		2 nos.
60.	Hammer Plastic		2 nos.
61.	Hammer ball peen	0.25 kg with handle	2 nos.
62.	Work bench	240 x 120 x 75 cm with 4 vices 15cm Jaw	5 nos.
63.	Magnifying glass	75mm	2 nos.
64.	'V' Block	75 x 38 mm pair with Clamps (Hardened and ground) as per IS2949	2 nos.
65.	C Clamps	100mm	2 nos.
66.	C Clamps	150mm	2 nos.
67.	C Clamps	200mm	2 nos.
68.	Spanner, adjustable upto	15cm.	2 nos.
69.	Spark plug spanner	14mm x 18mm x Size	2 nos.
70.	Spanners socket with speed handle, T-bar, ratchet and universal	up to 32 mm set of 28 pieces with box	2 nos.
71.	Pipe wrench	350 mm	2 nos.
72.	Spanner T. flex for screwing up and up-screwing inaccessible		2 nos.
73.	Spanner Clyburn	15 cm	1 no.
74.	Magneto spanner set	with 8 spanners	1 set
75.	Piston ring filing jig		2 nos.
76.	Cylinder ridge cutter		1 no.
77.	Vice grip pliers		10 nos.
78.	Circlip pliers Expanding and contracting type	15 cm and 20cm each	10 nos.
79.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
80.	Pneumatic tools set		1 no.
81.	Car Jet washer		1 no.
82.	Pipe flaring tool		1 no.

83.	Pipe cutting tool		1 no.
84.	Universal puller for removing pulleys, bearings		1 no.
85.	Cleaning tray	45x30 cm.	4 nos.
86.	Cleaning tray- Aluminium	45 x 30 cm	4 nos.
87.	Stud extractor set of 3		2 sets
88.	Stud remover with socket handle		1 no.
89.	Paraffin pressure Gun		2 nos.
90.	Grease Gun		2 nos.
91.	Hacksaw frame adjustable	20-30 cm	4 nos.
92.	Files assorted sizes and types including safe edge file (20 Nos)		2 sets
93.	Drill twist, metric straight shank	3 mm to 12 mm in step of 0.5 mm	1 set
94.	Drill point angle gauge		1 no.
95.	Set of stock and dies - UNC, UNF and metric		2 sets each
96.	Taps and wrenches - UNC, UNF and metric		2 sets each
97.	Taps and Dies complete sets (5 types)		1 set each
98.	Hand reamers adjustable	10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	2sets each
99.	Lapping abrasives (consumable)		As required
100.	Oil can	0.5/0.25 litter capacity	2 nos.
101.	Oil Stone	15 cm x 5 cm x 2.5 cm	1 no.
102.	Straight edge gauge	2 ft.	1 no.
103.	Straight edge gauge	4 ft.	1 no.
104.	Thread pitch gauge metric, BSX, BSF, MC, MF & SAE		1 each
105.	Ladle	150mm Dia	1 no.
106.	Blow Lamp	1 litre	2 nos.
107.	Crow bar	910 x25mm	2 nos.
108.	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
109.	Wire Gauge (metric)		5 nos.
110.	Hand operated crimping tool	(i) for crimping up to 4mm and (ii) for crimping up to 10 mm	2 nos.
111.	Hand rubber gloves tested for CONSUMABLES	5000 V	5 pair
112.	Digital Multi meter, 3 ½ Digit(min),Diode test mode and continuity mode, accuracy ±0.01%	range of 0-500v AC/DC, 0-10A AC/DC	5 nos.
113.	Growler		1 no.

114.	Hydrometer (CONSUMABLE)		10 nos.
115.	Battery analyzer with printer		1nos.
116.	Carburetor - Solex, Mikuny for dismantling and assembling		1 each
117.	Philips align key set		1 set
118.	Starter motor axial type, pre-engagement type & Co-axial type		3each
119.	Distributor -Duel advance type, reluctance type		3 each
120.	Tester sparking plug 'NEON' Type		1 no.
121.	Alternator assembly used for LMV		2 nos.
122.	Starter motor assembly used for LMV		2 nos.
123.	Electronic engine control module		1 no.
124.	Fuel feed pump		2 nos.
125.	Fuel pump for MPFI		2 nos.
126.	Inline fuel injection pump and rotor type fuel injection pump		2nos.each
127.	Petrol nozzle		8 nos.
128.	Drift copper	10 mm dia x 150 mm	2 nos.
129.	Piston ring compressor		4 nos.
130.	Piston ring expander		1 no.
131.	Valve spring compressor		1 no.
132.	Valve seat cutter complete set with guide and pilot bar (all angle in a		1 set
133.	Timing light		1 no.
134.	Tachometer digital		1 no.
135.	Battery	12V (Lead acid &Alkaline)	4 nos.
136.	Electrical horn (different types)		2 sets
137.	AC alternator slip ring puller		1 no.
138.	Executive Auto Electrical tool kit		2 nos.
139.	Magnetic stick		1 no
140.	Piston ring groove cleaner		1 no
141.	Oil filter wrench adjustable		1 no
142.	Looking glass		1 no
143.	Coil spring compressor for suspension spring		1no.
144.	Turbo charger, variable Turbo charger		1 each

145.	Timing Light with tachometer		1 no.
146.	Battery Tester	12V	1 no.
147.	Spark Plug spanner		1 no.
148.	Sparkplug gap gauge		1 no.
149.	Ambient temp. gauge		1 no.
150.	Working model of wiper along with wind shield		1 no
151.	Wiper motor assembly		1 no
152.	Car stereo		1 no
C. GENERAL INSTALLATIONS /MACHINERIES			
153.	Demonstration board of 2Wheeler Ignition system.		1 no.
154.	Demonstration board of electronic Ignition system.	4W	1 no.
155.	Spark Plug cleaning and testing equipment		1 no.
156.	Working Condition of Petrol MPFI Engine Assembly with fault simulation board		2 nos.
157.	MPFI petrol engine with swiveling stand along with special tools for dismantling and assembling		2 nos.
158.	Demonstration board of MPFI system		1 no.
159.	Ultrasonic Injection cleaning equipment		1 no.
160.	Working Model of power windows		2 nos.
161.	Petrol Engine Motor Cycle/Scooter along with special tools and accessories	2-stroke	2 nos.
162.	Cut model	4 stroke Petrol engine on stand	1 no.
163.	Cut model	2 stroke Petrol engine on stand	1 no.
164.	Mechanical Hoist/Plate Form Type		1 no.
165.	Multi scan tool /ECU diagnostics kit		1 no.
166.	Four stroke multi cylinder diesel engine in working condition		4 nos.
167.	Four stroke four cylinder CRDI diesel engine in working condition		2 nos.
168.	Functional/experiment model of different type of sensors.		1 set
169.	Auto Electrical test bench		2 nos.

170.	Cut section Model of Mock layout of a motor car -electrical system - working model		1 set
171.	Battery charger	6 - 72 v for charging with cut off circuit	1 no.
172.	Trolley type portable air compressor single cylinder	with 45 liters capacity Air tank, along with accessories & with working pressure 6.5	1 no.
173.	Grinding machine (general purpose)	D.E. pedestal with 300 mm dia wheel s rough and smooth	1 no.
174.	Portable electric drill Machine		1 no.
175.	Spring tension tester		1 no.
176.	Valve refacing refitting achine		1 no.
177.	Injector testing machine for diesel		1 no.
178.	Smoke meter for Diesel with camera and printer		1 no.
179.	Exhaust gas analyser with camera and printer		1 no.
180.	Connecting rod alignment fixture		1 no.
181.	Engine lifting crane (jib)		1 no.
182.	Oil draining trolley		1 no.
183.	Engine cranker crank case	12v/24v,upto 500 amps to start engine	1 no.
184.	Stretcher trolley for under chassis working		1 no.
185.	Cut section working model of Single plate clutch assembly.		2 nos.
186.	Cut section working model of Diaphragm clutch assembly.		2 nos.
187.	Cut section working model of centrifugal clutch assembly.		2 nos.
188.	Front axle (Rezeppa Joint) with stand for Dismantling and assembly		2 nos.
189.	Rear axle with stand for Dismantling and assembly		2 nos.
190.	Constant Mesh Gear box with stand for Dismantling and assembly.		2 nos.
191.	Sliding mesh Gear box with stand for Dismantling and assembly.		2 nos.
192.	Synchronous Gear box with		2 nos.

	stand for Dismantling and assembly.		
193.	Transfer case with stand for Dismantling and assembly.		2 nos.
194.	Cut section model of synchronous gear box working		1no.
195.	Cut section model of sliding mesh gearbox working		1no.
196.	Cut section model of constant mesh gearbox working		1no.
197.	Full floating axle and semi-floating axle assembly		2 nos.
198.	Cut section working model of automatic transmission Gear box		1no.
199.	Working model of fluid fly wheel		1no.
200.	Working model of torque converter		1no.
201.	Steering assembly - 1. Rack& pinion, 2.Worm& roller3. Recirculating ball 4.Power steering		2 each
202.	Cut section models of shock absorbers		1no.
203.	Stock absorber testing bench		1no.
204.	Wheel alignment setup instrument-computerised		1no.
205.	Tyre changer		1no.
206.	Nitrogen Tyre Inflation system		1no.
207.	Tube vulcanizing machine		1no.
208.	Wheel balancing machine with accessory		1no.
209.	Tubed tyre of car, trucks & motorcycle		1no.
210.	Tubeless tyre of car & truck		1no.
211.	Cut section of cross ply and radial tyres		1no.
212.	Working models of Disk brake with caliper assembly		2 nos.
213.	Drum brake assembly		1no.
214.	Tandem master cylinder with booster		4 nos.
215.	Wheel cylinder		4 nos.
216.	Vacuum assisted hydraulics brake assembly along with		1no.

	vacuum booster and Front Disk brake assembly and Rear side Drum brake assembly		
217.	Working model of Air Brake Assembly		1no.
218.	Brake testing equipment (to test efficiency of vehicle where motion after braking is plotted)		1no.
219.	Motor vehicle in running condition (Diesel heavy) with hydraulic power steering		1no.
220.	Light Motor Vehicle Diesel CRDIwith electronic power steering and car a/c		1no.
221.	Mechanical Hoist/Plate Form Type		1no.
222.	Trolley type portable air compressor single cylinder Air tank, along with accessories & with working pressure	with 45 liters capacity 6.5 kg/sq cm	1no.
223.	Grinding machine (general purpose) D.E. pedestal	with 300 mm dia wheels rough and smooth	1no.
224.	Portable electric drill Machine		1no.
225.	Spring tension tester		1no.
226.	Multi scan Tool / ECU Diagnostic kit		1no.
227.	Engine Dynamometer		1no.
228.	Four stroke multi cylinder engine MPFI petrol with CNG kit set up in running condition		1no.
229.	LPG conversion kit along with tank fitted on a stand		1no.
230.	Car A.C unit working model of car A/C unit with charging unit with Engine		1no.
231.	Single cylinder four stroke stationary diesel engine		2 nos.
232.	Bench drilling machine		1no.
233.	Battery charger		1no.
234.	Brake Bleeding Blading Machine		1no.
235.	a/c gas refilling m/c		1no.
236.	CRDI service tool kit		1 set
237.	A light motor vehicle petrol & LPG driven		1 no.

238.	HYDRAULIC PRESS		1no.
239.	A light motor vehicle CNG driven		1no.
240.	Induction stove	230 V	1 no.
241.	Beaker (consumable)		1 no.
242.	Thermometer	Range Max 150 deg C	1 no.

ANNEXURE – I

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

List of Expert members participated for finalizing the course curriculum of Mechanic Motor Vehicle (CITS) trade.

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5.	S. Karthikeyan, Regional Training Manager	Maruti Suzuki India Ltd., Tamilnadu	Member
6.	N. Balasubramaniam	ASDC	Member
7.	P. Murugesan,	TVS TS Ltd., Ambattur Industrial Estate, Chennai-58	Member
8.	R. Jayaprakash	Ashok Leyland Driver Training Institute, Namakkal	Member
9.	Mr. Veerasany, GM, E. Sakthivel	Maruti Suzuki India Ltd.	Member
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13.	S. Mathivanan, Jt. Director	ATI, Chennai-32	Member
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15.	Dinesh Babu K.K., Chief Instructor	Carriage & Wagon Works, Southern Railway	Member
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21.	Nirmalya Nath, Asst. Director	CSTARI, Kolkata	Member
22.	Akhilesh Pandey, TO	-do-	Member
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28.	Lokesh Kumar Manger Training Academy	Volkswagen India Pvt Ltd Pune	Member
29.	Shriram Tatyaba Khaire Executive Engineering.	Sulzer India Pvt Ltd. Kondhapuri, Shirur, Pune	Member
30.	Milind P Desai Sr. Shift Engineer	Atlas Copco (I) Ltd Dapodi, Pune	Member
31.	Shrikant Mujumdar Dgm	John Deere India Pvt Ltd. Pune - Nagar Road, Sanaswadi, Pune	Member
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33.	Rajesh Menon Unit Manager	Alfa Laval India Ltd. Dapodi, Pune.	Member
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36.	Rajendra Shelke Sr. Engineer Mfg.	Premium Transmission Ltd. Chinchwad, Pune - 19	Member
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47.	Arnold Martin	Godrej & Boyce Mfg Co Ltd, Mumbai	Member
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54.	S. Venkata Krishna, Dy. Manager	Maruti Suzuki India Ltd., Chennai	Member
55.	S. Karthikeyan, Regional Training Manager	MAruti Suzuki India Ltd., Tamilnadu	Member
56.	N. Balasubramaniam	ASDC	Member
57.	P. Murugesan,	TVS TS Ltd., Ambattur Industrial Estate, Chennai	Member
58.	R. Jayaprakash	Ashok Leyland Driver Training Institute, Namakkal	Member
59.	Mr. Veerasany, GM, E. Sakthivel	Maruti Suzuki India Ltd.	Member
60.	M. Madasaniy, Principal	Ramco ITI, Rajapalayam, Tamil Nadu	Member
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62.	Akhilesh Pandey	CSTARI, Kolkata	Member cum Co-coordinator
63.	Amar Prabhu, Principal	Don Bosco, Mumbai	Expert
64.	Indranil Mukherjee, Instructor	ITI, Tollygaunj	Expert
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66.	K. Thaniyaraju, Principal I/C	Gov. ITI, Virali Malai, DET-Chennai	Member
67.	S. Mathivanan, Jt. Director	ATI, Chennai	Member
68.	R. Rajesh Kanna, T.O	ATI, Guindi, Chennai	Member
69.	Dinesh Babu K.K., Chief Instructor	Carriage & Wagon Works, Southern Railway	Member
70.	Suresh Awaji, Manager- Service Training	Ashok Leyland Ltd, Chennai	Member
71.	N. Ramesh Kumar, TO	ATI, Chennai	Member
72.	R. Senthil Kumar, Director	ATI/MSDE/CTI Campus, DGT, Gundia, Chennai	Member
73.	C. Yuvraj	ATI- Chennai	Member
74.	Balajirao. S, Body shop In charge	CUU romotors, 15/16, Thiruvika Industrial Estate, Guindy, Chennai	Member


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