CURRICULUM

FOR THE TRADE OF

MECHANIC MOTOR VEHICLE

UNDER

APPRENTICESHIP TRAINING SCHEME (ATS)

सत्यमेव जयते
Government of India

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

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1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.

2. RATIONALE

(Need for Apprenticeship in MECHANIC MOTOR VEHICLE trade)

The revised Apprenticeship Training Scheme (ATS) shall make the students more adapt to industry requirement through latest theoretical & practical inputs as -

1. Good synergy between Basic Training (Theoretical Inputs) & Practical Training (On The Job Training) unlike earlier scheme where students need to complete two years classroom training before getting Practical Training (On The Job Training).

2. Students will be thoroughly skilled for maintenance, repair & servicing of latest technology driven vehicles.

3. Students will be equipped to handle fault measurement and diagnostic according to new mechanical and electronics technology. Examine vehicle to ascertain nature and location of defects either by running engine or driving vehicle on road.

4. Dismantling and assembling defective unit or parts of vehicle such as engine, gear box, rear axle, front axle, steering assembly, radiator, retarder and other new technology aggregate etc. according to nature of repairs to be done, using hoist, jack, pullers, hand tools and hand truck pallet.

5. Measures essential parts like cylinder, bores piston, sizes crank pins etc. using gauges, micrometre and other precision tools and get cylinders re-bored, liners filled, valve seats refaced, bearings replaced etc. as necessary.

6. Repairs or overhauls and assembles engine such as replacing defective parts, scrapping bearings, setting timing, cleaning injectors, tuning carburettor etc. according to maker's specification.

7. Replacement and repair of 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.

8. Relines and builds brakes, sets wheel alignment, adjust steering, clutch & hand brakes etc. Fit new or repaired accessories and body parts, make electrical connection, and perform other tasks.

9. Students will be able to read & understand manual related to lubricants, joints, loose parts and test performance of vehicle by driving on road and makes necessary adjustments to attain desired standard.

3. JOB ROLES: REFERENCE NOS& NCO

Brief description of Job roles:

- Mechanic Motor Vehicle: **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.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity, understand and implement technical English. Sensitive to environment, self-learning and productivity.

Reference NCO & NOS:

i) **NCO-2004: 7231.10**

NOS:-

ii) **A**SC/ Q 1401, (Automotive Service Technician L3)

iii) ASC/ Q 1402 (Automotive Service Technician L4)

iv) ASC/ Q 1408 (Automotive Electrician Level 4)

v) ASC/Q3601 (Vehicle Assembly Fitter)

4. LEARNING OUTCOMES

A. GENERIC OUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Illustrate concept and principles of basic arithmetic calculation, algebraic, trigonometric, statistics and apply knowledge of specific area to perform practical operations which requires well developed skills.
4. Explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.
5. Read and apply engineering drawing for different application in the field of work.
6. Explain the knowledge of general concept, principles of productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
7. Explain the general concept and process of energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
8. Explain and display sensitivity towards personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
9. Apply the general concept of basic computer, basic operating system and uses of internet services to take benefit of IT developments in the industry.

B. SPECIFIC OUTCOME

Block-I

10. Plan & perform basic fastening & fitting operations of various parts of vehicle using various tools and equipment observing standard procedure used in automotive workshop.
11. Trace and Test Electrical and Electronic Components and Circuits and assemble to ensure functionality of system

12. Overhaul Charging and Starting System of vehicle as per standard procedure and check functioning of system.
13. Repair/ replace the defective gauges fitted on dashboard and check engine performance.
14. Overhaul and service Diesel Engine, its parts as per standard procedure, analyze engine and check functionality.
15. Service Diesel Fuel System as per manufactures guidelines and check proper functioning.
16. Analyze and adjust Engine Emissions Control Systems.

Bock-II

17. Plan and overhaul the Petrol Engine, check functionality and analyze to perform engine tune up.
18. Test functionality of Multi Point Fuel Injection Components and Electronic Components of Petrol Vehicle and analyze to repair/ replace defective gauges.
19. Overhaul and Service the Air Conditioning system Components, Air Conditioning and check functionality of system.
20. Perform Service and Overhauling of transmission system, test system and analyze test report for proper functioning.
21. Carryout overhauling of light /Heavy vehicle chassis system including steering, suspension and braking system as per standard procedure and check functionality.
22. Carry out removal, repair and fitting, wheel balancing activities of tyres and tubes of light & Heavy vehicle as per standard procedure.
23. Diagnose and troubleshoot the electrical system accessories of vehicle.
24. Drive, diagnose and trouble shoot faults in the vehicle.

NOTE: Learning outcomes are reflection of total competencies of a trainee. Each learning outcome may include multiple assessment components. However assessment will be carried out as per assessable outcome and assessment criteria.

5. NSQF LEVELCOMPLIANCE

NSQF level for MECHANIC MOTOR VEHICLE trade under ATS:
Level 5

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.
Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.
Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. professional knowledge,
c. professional skill,
d. core skill and
e. Responsibility.

The Broad Learning outcome of MMV trade under ATS mostly matches with the Level descriptor at Level- 5.

. The NSQF level-5 descriptor is given below:

LEVEL	Process required	Professional knowledge	Professional skill	Core skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	knowledge of facts, principles, processes and general concepts, in a field of work or study	a range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and Learning and some responsibility for other's works and learning.

6. GENERAL INFORMATION

1. **Name of the Trade** : **MECHANIC MOTOR VEHICLE**

2. **N.C.O. / N. O. S. Code No.** : **7231.10,** ASC/ Q 1401, ASC/ Q 1402, ASC/ Q 1408

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):** 2years

4. **Duration of Basic Training**: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: 6 months

5. **Duration of Practical Training (On -job Training): -**

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

6. **Entry Qualification** : Passed 10th Class with Science and Mathematicsunder10+2 system of Education or its equivalent

7. **Selection of Apprentices:** The apprentices will be selected as per Apprenticeship Act amended time to time.

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

7. COURSE STRUCTURE

Training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	Block– I	-----	Block – II	------
Practical Training (On - job training)	----	Block – I	------	Block – II

Components of Training	Duration of Training in Months →																							
↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

8. ASSESSABLE OUTCOME/ LEARNING OUTCOME WITH ASSESSMENT CRITERIA

Competencies after completion of 02years MECHANIC MOTOR VEHICLE trade:

A. GENERIC ASSESSABLE OUTCOME

ASSESSABLE OUTCOMES	REF. SYLLABI	ASSESSMENT CRITERIA
1. Recognize & comply safe working practices, environment regulation and housekeeping.	BLOCK-I (BT-Wk. No.1 & OJT-Wk.No.1)	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
		1.2 Recognize and report all unsafe situations according to site policy.
		1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
		1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
		1.5 Identify and observe site policies and procedures in regard to illness or accident.
		1.6 Identify safety alarms accurately.
		1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
		1.8 Identify and observe site evacuation procedures according to site policy.
		1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
		1.10 Identify basic first aid and use them under different circumstances.
		1.11 Identify different fire extinguisher and use the same as per requirement.
		1.12 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
		1.13 Deploy environmental protection legislation & regulations
		1.14 Take opportunities to use energy and materials in an environmentally friendly manner
		1.15 Avoid waste and dispose waste as per procedure
		1.16 Recognize different components of 5S and apply the same in the working environment.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	BLOCK-I, OJT-Wk. No.2 &Item No. 9.1.3.1 Block –I	2.1 Obtain sources of information and recognize information.
		2.2Use and draw up technical drawings and documents.
		2.3 Use documents and technical regulations and occupationally related provisions.
		2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
		2.5 Present facts and circumstances, possible solutions &use

		English special terminology.
		2.6 Resolve disputes within the team
		2.7 Conduct written communication.
3. Illustrate concept and principles of basic arithmetic calculation, algebraic, trigonometric, statistics and apply knowledge of specific area to perform practical operations which requires well developed skills.	Item No. 9.1.1 Block – I & II	3.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.
		3.2Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
4. Explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	Item No. 9.1.1 Block – I & II	4.1 Semester examination to test basic skills on science in the field of study including basic electrical and hydraulics & pneumatics.
		4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
5. Read and apply engineering drawing for different application in the field of work.	Item No. 9.1.1 Block – I & II	5.1 Semester examination to test basic skills on engineering drawing.
		5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
6. Explain the knowledge of general concept, principles of productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	Item No. 9.1.3.1 Block –II	6.1 Semester examination to test the concept in productivity, quality tools and labour welfare legislation.
		6.2 Their applications will also be assessed during execution of assessable outcome.
7. Explain the general concept and process of energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	Item No. 9.1.3.1 Block –II	7.1 Semester examination to test knowledge on energy conservation, global warming and pollution.
		7.2 Their applications will also be assessed during execution of assessable outcome.
8. Explain and display sensitivity towards personnel finance, entrepreneurship and manage/organize	Item No. 9.1.3.1 Block –II	8.1 Semester examination to test knowledge on personnel finance, entrepreneurship.
		8.2 Their applications will also be assessed during execution of assessable outcome.

related task in day to day work for personal & societal growth.		
9. Apply the general concept of basic computer, basic operating system and uses of internet services to take benefit of IT developments in the industry.	Item No. 9.1.3.1 Block –I	9.1 Semester examination to test knowledge on basic computer working, basic operating system and uses internet services.
		9.2 Their applications will also be assessed during execution of assessable outcome.

B. SPECIFIC ASSESSABLE OUTCOME:

Block –I

ASSESSABLE OUTCOMES	REF. SYLLABI	ASSESSMENT CRITERIA
10. Plan & perform basic fastening & fitting operations of various parts of vehicle using various tools and equipment observing standard procedure used in automotive workshop.	BT -Wk No.2,4 OJT- Wk No.2,4	10.1 Plan, select and ascertain appropriate tools and equipment for fastening & fitting operations and make these available for use in a timely manner.
		10.2 Identify various parts of vehicles.
		10.3 Measure all dimensions in accordance with standard specifications and tolerances by using precision measuring instruments.
		10.4 Use appropriate hand tools, Cutting Tool, Power/Pneumatic Tools, Special Tools and General Purpose Tools to undertake fastening & fitting operations as per standard prodcedure.
		10.5 Check all dimensions in accordance with specification.
11. Trace and Test Electrical and Electronic Components and Circuits and assemble to ensure functionality of system.	BT -Wk No. 5, 6	11.1 Plan and organize the work for basic electrical operations.
		11.2 Select the tools, instruments and materials required to do the job.
		11.3 Comply with safety rules when performing the basic electrical operations.
		11.4 Trace and Test Wiring circuits in Electrical and Electronic system and components.
		11.5 Perform electrical wire joints, form electrical circuits and test basic electrical parameters as per the circuit drawings and operating procedures.
		11.6 Test continuity and voltage drop in the electrical circuits.
		11.7 Operate the electrical components in a vehicle and test lamps.
12. Overhaul Charging and Starting System of vehicle as per standard procedure and check functioning of system.	BT-Wk No.6 OJT- Wk No.11-14 & 17-18	12.1 Check Charging system for proper functioning as per manufacturer guidelines
		12.2 Service alternator as per standard procedure for proper functioning
		12.3 Check starting system for proper functioning as per manufacturer guidelines
		12.4 Check starter for proper functioning
		12.5 Service starteras per standard procedure.
		12.6 Check functioning of charging and starting system.'

13. Repair/ replace the defective gauges fitted on dashboard and check engine performance.	BT - Wk No. 7	12.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
		12.2 Identify gauges fitted on the dashboard and check for proper functioning.
		12.3 Perform daily checks before starting the engine.
		12.4 Start the engine.
		12.5 Identify the problem in functionality of particular Gauge fitted on dashboard.
		12.6 Record the reading and compare it with standard reading.
		12.7 Repair / Replace the defective gauges as per standard operating practice.
		12.8 Check for proper functionality
14. Overhaul and service Diesel Engine, its parts as per standard procedure, analyze engine and check functionality.	BT - Wk No.8-11 OJT- Wk No.11-29	13.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
		13.2 Check coolant and lubricants levels of the engine and Top-up or Replace.
		13.3 Service Cooling system, Lubricating system, cylinder head assembly, Piston and connecting Rod Assembly, Flywheel, Crank shaft, camshaft & its bearings and gear, cylinder block as per standard procedure.
		13.4 Check, analyze and adjust valve clearances as per procedure and recommended specification.
		13.5 Refit all the accessories.
		13.6 Check Fan/Alternator Belt for proper tension.
		13.7 Overhaul Air Compressor, Exhauster Assembly, Intake and Exhaust System Parts as per standard procedure.
		13.8 Analyze & check functionality of diesel engine and its parts.
15. Service Diesel Fuel System as per manufactures guidelines and check proper functioning.	BT- Wk No.12 OJT- Wk No.30-32	14.1 Check leakages in fuel line.
		14.2 Service Fuel Tank
		14.3 Replace Fuel Filter & Feed pump
		14.4 Set Fuel Injection Pump Timing as per manufacturer specification
		14.5 Service Fuel Injectors as per manufacturer's guidelines and Bleed the Fuel System to vent out any air trapped.
		14.6 Start the Engine and check for proper functioning.
16. Analyze and adjust Engine Emissions Control Systems.	BT- Wk No.13 OJT- Wk No.33-36	15.1 Analyze Engine Emission by using Gas Analyzer or Smoke meter.
		15.2 Service Positive Crankcase Ventilation Valve
		15.3 Check and Replace Evaporative Canister, Exhaust Gas Recirculation /Selective Catalyst Reduction Valve
		15.4 Check and Service Vapour Recovery System of Engines
		15.5 Check and Test Catalytic Converter

Block –II

ASSESSABLE OUTCOMES	REF. SYLLABI	ASSESSMENT CRITERIA
17. Plan and overhaul the Petrol Engine, check functionality and analyze to perform engine tune up.	BT- Wk No.1 OJT- Wk No.1-5	17.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
		17.2 Plan work in compliance with standard safety norms.
		17.3 Remove a petrol engine from the vehicle as per vehicle manufacturer standard procedure.
		17.4 Dismantle the petrol engine as per standard sequence
		17.5 Overhaul the cylinder head assembly, piston and connecting rod assembly as per standard procedure.
		17.6 Check the cylinder bore wear andanalyze measurements as per standard specification.
		17.7 Assemble the petrol engine as per sequence
		17.8 Check, analyze and adjust valve clearances as per procedure and recommended specification of engine manufacturer
		17.9 Test vacuum and compression of engine
		17.10 Analyze and make carburetor adjustments
		17.11 Check functionality of petrol engine.
18. Test functionality of Multi Point Fuel Injection Components and Electronic Components of Petrol Vehicle and analyze to repair/ replace defective gauges.	BT- Wk No.2,3 OJT- Wk No.6-8	18.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
		18.2 Plan work in compliance with standard safety norms.
		18.3 Identify, locate and test the sensors fitted in the given Multi Point Fuel Injection engine
		18.4 Check the function of Malfunction 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
		18.5 Analyze and repair / replace the defective gauges as per standard operating practice.
		18.6 Test the various sensors fitted on the given engine using multi meter/scan tool
19. Overhaul and Service the Air Conditioning system Components, Air Conditioning and check functionality of system.	BT- Wk No.6 OJT- Wk No.9-11	19.1Ascertain and select tools and materials for the job and make this available for use in a timely manner.
		19.2Plan work in compliance with standard safety norms.
		19.3Identify and LocateComponents of Car Air Conditioning/Heated Ventilation Car Air Conditioning system (HVAC System)
		19.4Carryout the diagnostic procedure for the troubles.
		19.5Carryout Repair/ Service AC System Components.

		19.6 Check functionality of AC system.
20. Perform Service and Overhauling of transmission system, test system and analyze test report for proper functioning.	BT- Wk No.7,8 OJT- Wk No.14-19	20.1Select and wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities.
		20.2Select tools and materials for the job and make this available for use in a timely manner.
		20.3Ascertain that equipment has been calibrated to meet manufacturers' and legal requirements
		20.4Work in compliance with standard safety norms.
		20.5Carryout removal and replacement activities of system by reviewing vehicle technical data and legal requirements.
		20.6Use technical information to support the overhauling of light vehicle/Heavy Vehicle transmission units.
		20.7Perform all overhauling of vehicle transmission units adhering to the specifications and tolerances for the vehicle andStandard repair methods.
		20.8Conduct appropriate and target oriented discussions with higher authority and within the team, where an overhaul is uneconomic or unsatisfactory to perform
		20.9Use testing methods that comply with the manufacturer's requirements.
		20.10 Adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements.
		20.11 Ensure replaced driveline units and assembliesconform to the vehicle operating specification and any legal requirements
		20.12 Rectify the defects following the vehicle manufacture standard procedure.
		20.13 Record the pressures in all ranges at idle and stall speeds
		20.14 Analyse recorded data and identify any faults and take necessary action to rectify.
		20.15 Check proper functioning of transmission system.
21. Carryout overhauling of light /Heavy vehicle chassis system including steering, suspension and braking system as per standard procedure and check functionality.	BT- Wk No.9,10 OJT- Wk No.20-23	21.1Select and wear suitable personal protective equipment and use vehicle coverings throughout all removal and replacement activities.
		21.2Select tools and materials for the job and make this available for use in a timely manner.
		21.3Ascertain that equipment has been calibrated to meet manufacturers' and legal requirements
		21.4Work in compliance with standard safety norms.
		21.5Carryout their removal and replacement activities by reviewing vehicle technical data and legal requirements.
		21.6Use technical information to support the overhauling of light vehicle/Heavy Vehicle steering and suspension system
		21.7Use the tools and equipment in the way specified by manufacturers to overhaul steering, suspension and braking system
		21.8 Perform all overhauling of light vehicle Chassis units adhering to the specifications, tolerances for the vehicle and Standard repair methods.
		21.9Conduct appropriate and target oriented discussions with higher authority and within the team, where an overhaul is uneconomic or unsatisfactory to perform
		21.10 Use testing methods that comply with the manufacturer's requirements.
		21.11 Adjust the unit's components correctly where necessary.

		21.12 Ensure replaced driveline units and assembliesconform to the vehicle operating specification and any legal requirements
		21.13 Check functionality of light vehicle /Heavy vehicle chassis system including steering, suspension and braking system.
22. Carry out removal, repair and fitting, wheel balancing activities of tyres and tubes of light & Heavy vehicle as per standard procedure.	BT- Wk No.11 OJT- Wk No.24-27	22.1Use suitable personal protective equipment and vehicle coverings when working on vehicles
		22.2Carry out inspection of wheels and tyres using appropriate techniques, suitable tools, equipment and manufacturer's instructions where relevant.
		22.3Carry out tyre repair/ replacement activities within appropriate timescales and observing standard procedure.
		22.4Carry out wheel balancing to within acceptable limits.
		22.5Carry out final vehicle safety checks in the workshop as per standard procedure.
		22.6Rectify the defects following the vehicle manufactures standard procedure.
		22.7 Check for proper working of tyres.
23. Diagnose and troubleshoot the electrical system accessories of vehicle.	BT- Wk No.13 OJT- Wk No. 28-30	23.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
		23.2 Plan work in compliance with standard safety norms.
		23.3 Carryout the diagnostic procedure for the loose connection, short circuits, Blown fuse, bulb, faulty relay and switch troubles in the electrical system accessories.
		23.4 Check proper functioning of electrical system of vehicle.
24. Drive, diagnose and trouble shoot faults in the vehicle.	OJT- Wk No.31-33	24.1 Follow the Road safety measures, Traffic rules and statutory regulations.
		24.2 Drive under different conditions.
		24.3 Trace troubles during driving the vehicle
		24.4 Locate the troubled system of the vehicle
		24.5 Diagnose and trouble shoot the defect
		24.6 Check proper functioning of the vehicle

***Note*: - BT – BASIC TRAINING**

OJT – ON JOB TRAINING

9. SYLLABUS
9.1 BASIC TRAINING
(BLOCK – I &II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** :**MECHANIC MOTOR VEHICLE**

2) **Hours of Instruction** : 1040 Hrs. (40 hrs./week X 26 weeks)

3) **Batch size** : 20

4) **Power Norms** : 4.8 KW for Workshop

5) **Space Norms** : 210 Sq.m. (Including Parking area)

6) **Examination** : The internal examination/ assessment will be held on completion of each Block.

7) **Instructor Qualification** :

i) Degree/Diploma in Automobile/Mechanical Engg.from recognized university/Board with one/two year post qualification experience in the relevant fieldand should possess valid LMV driving license.

OR

ii) NTC/NAC in the trade of MMV with three year post qualification experience in the relevant fieldand should possess valid LMV driving license.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required** : - As per Annexure – I

9.1.1 DETAIL SYLLABUS OF CORE SKILL

Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
		30		**20**
1	**Engineering Drawing: Introduction and its importance** - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003		**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	
2	**Drawing Instruments : their uses** Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.		**Fractions**: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Calculator.	
3	**Lines:** - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line Methods of Division of line segment		**Properties of Material** : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous Alloys.	
4	**Drawing of Geometrical Figures:** Drawing practice on: - Angle: Measurement and its		**Average :** Problems of Average. **Ratio & Proportion** : Simple calculation on related problems.	

	types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.		**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density.	
5	**Dimensioning:** - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text			
6	**Free hand drawing of** - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.			
7	**Method of presentation of Engineering Drawing** - Pictorial View - Orthogonal View - Isometric view		**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	
8	**Symbolic Representation (as per BIS SP:46-2003) of :** - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings		- Forces definition. - Definition and example of compressive, tensile, shear forces, axial and tangential forces. Stress, strain, ultimate strength, factor of safety for MS. **Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	
9	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance.		**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere. - Area of cut-out regular surfaces: circle and segment and sector of circle.	

			- Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple solid blocks.	
10	**Construction of Geometrical Drawing Figures:** - Polygons and their values of included angles. Conic Sections (Ellipse)		**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). - Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force.	
11	**Projections:** - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification. Drawing of Orthographic projection from isometric/3D view of blocks		**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	

Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1	- Machined components; concept of fillet & chamfer; surface finish symbols.	**30**	**Trigonometry:** Trigonometric ratios, Trigonometric tables. - Finding the value of unknown sides and angles of a triangle by Trigonometrical method. - Finding height and distance by trigonometry.	**20**
			Friction and its application in Workshop practice.	
2	- Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.		**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	
3	- Reading & interpretation of assembly drawing and detailing.		**Basic Electricity**: Introduction, use of electricity, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing.	
			Heat treatment – Necessity, different common types of Heat treatment.	

			<u>Graph:</u> - Read images, graphs, diagrams – bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	
4	- Reading of drawing. Simple exercises related to missing lines, dimensions and views. How to make queries.		**Transmission of power:** By belt, pulleys & gear drive.	
5	- Simple exercises related to trade related symbols. - Solution of NCVT test papers.		**Concept of pressure** – units of pressure, atmospheric pressure, gauge pressure – gauges used for measuring pressure. **Introduction to pneumatics & hydraulics systems.** Solution of NCVT test papers	

9.1.2DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

Block –I

Basic Training

Week No	Professional Skill	Professional Knowledge
1	Importance of trade training, List of tools & Machinery used in the trade. **Occupational Safety & Health** **Importance of housekeeping & good shop floor practices.** Health & Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Health, Safety and Environment guidelines. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Personal protective Equipments(PPE):- Use of Fire extinguishers. Job opportunities in the automobile sector, Importance of maintenance and cleanliness of Workshop. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of Used engine oil.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. **Soft Skills: its importance and Job area after completion of training.** Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Environment guidelines. Legislations & regulations as applicable. Response to emergencies eg; power failure, fire, and system failure. Introduction to the Course duration, course content, study of the syllabus. 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. Safety disposal of Used engine oil, Electrical safety tips.
2	Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc., Layout a work piece- for line, circle, arcs and circles. Practice to measure a wheel base of a vehicle with measuring tape. Practice to measure valve spring tension using spring tension tester Practice to remove wheel lug nuts with use of an air impact wrench Practice on General workshop tools & power	Auto Industry in India-History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and R&D Infrastructure Project (NATRIP), & Automobile Association. Classification of vehicles.Identification of vehicle information Number (VIN). Hand & Power Tools:- Marking material.

	tools and equipments.	Sockets & accessories, Pliers. Pneumatic and Power Tools.
3	Practice on General cleaning, checking and use of nut, bolts, & studs etc., Removal of stud/bolt from blind hole. Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. Practice on Hacksawing and filing to given dimensions. Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor.	Cutting tools. Fasteners. Limits, Fits & Tolerances. Taps and Dies. Welding techniques. Sheet metal.
4	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. Practice on Liquid penetrant testing method and Magnetic particle testing method. Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding. Setting of Gas welding flames, practice to make a straight beads and joints Oxy – Acetylene welding Practice on making Rectangular Tray. Pipe bending, Fitting nipples unions in pipes. Soldering and Brazing of Pipes Identification of Hydraulic and pneumatic components used in vehicle. Tracing of hydraulic circuit on hydraulic power steering, and Brake circuit.	Hand Taps and wrenches. Hand Reamers. Mechanical properties of materials, Engineering Material Used in Automotive Industry. Non-destructive Testing Methods Welding processes Introduction to Hydraulics & Pneumatics: -
5	Practice in joining wires using soldering Iron, Construction of simple electrical circuits, Measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers Diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure current flow using multimeter /ammeter, use of	Basic electricity, Electricity principles. Fuses & circuit breakers in Automotives Description of Chemical effects, Batteries & cells, Lead acid batteries& Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermisters, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.

	service manual wiring diagram for troubleshooting. Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit.	
6	Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality, Practice on removing starter motor from vehicle. Checking a starting system, Jump-starting a vehicle 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. Trace the wiring circuit of traffic signal flashers light circuit-tracing Defects in the flasher circuits, replacing fuse bulb.	Basic electronics: Description of Semiconductors, Solid state devices. 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. Lighting system, Lamps/light bulbs, Lamp/light bulb information, LED lighting,. 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
7	Demonstration of Garage & Service station equipments.-Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition. Identification of parts in a diesel engine of LMV/ HMV Practice on dismantling Diesel engine of LMV/HMV as per procedure.	Brief description and uses of Vehicle hoists – Two posts and four post hoist, Engine hoists, Jacks, Stands. Study of various gauges/instrument on a dash board of a vehicle Procedure for dismantling of diesel engine from a vehicle. Principle of Spark Ignition engine, Differentiate between C.I. engine and S.I. Engine, 4-strokeand2 strokes, Otto cycle and Diesel cycle. Direct injection, Indirect injection, scavenging, Crankshaft rotation, Engine output, Power range.
8	Practice on starting and stopping of diesel engines.	Introduction to Engine: Description of internal & external combustion

	Demonstration of Diesel Engine Components.	engines, different types of I.C. Engines Diesel Engine Basics: Introduction, Compression- ignition engines- Description of 4-strokediesel principles and cycle, 2-strokediesel principles and cycle, Three phases of combustion. Different type of starting and stopping method of Diesel Engine. Diesel Engine Components: Description and Constructional feature of Cylinder head, Importanceof Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence.
9	Identify Valve train components, OHC, DOHC Demonstration of Piston. Practice on identifying different types of pistons.	Valves & Valve Trains Valve- timing diagram, Concept ofVariable valve timing. Description of Camshafts & drives. Description of Overhead camshaft, Technical Terms Related to Engine
10	Practice on Flywheel, vibration damper. Crankcase & oil pump, gears timing mark, Chain sprockets, chain tensioners etc. Demonstration on Engine Assembly	Engine and Its Components. Crankshaft, Camshaft, Flywheel, Connecting Rod, Piston, Piston Pin, Cylinder Head, Cylinder Block, Oil Cooler, Water jackets. Engine assembly procedure with aid of special tools and gauges used for engine assembling. Introduction to Gas Turbine, Comparison of single and two stage turbine engine, Difference between gas turbine and Diesel Engine.
11	Practice on cooling system	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.
12	Practice on FIP, Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, Demonstration on EDC, CRDI and HEUI Practice on Stationary oil engines. Starting and stopping of stationary engines.	Diesel Fuel Systems- 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 tanks & lines, Diesel fuel filters ,water separator , Lift pump, Plunger pump, Priming pump, Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs, Cummins & Detroit Diesel injection. 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. Marine & Stationary Engine:-Types, Double acting engines, opposed piston engines, starting systems, cooling systems, lubricating systems, supplying fuel oil, hydraulic coupling, reduction gear drive, electromagnetic coupling, electrical drive, generator and motors, supercharging
13	Demonstration of Emission control methods.	Emission Control:- Vehicle emissions Standards- Euro and Bhart II, III, IV, V Sources of emission, Combustion, Combustion chamber design. Types of emissions: Characteristics and Effect. 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
	Assessment/Examination 03days	

Block –II
Basic Training

Week No	Professional Skill	Professional Knowledge
1	Identification of petrol Engine components. Practice on starting and stopping of petrol engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition. Identification of different major components of Heavy vehicle and their function & placement study of different make lorry/bus/tractor in Institute with different dealers or organizations. Removing a petrol engine from a motor vehicle. Dismantling cylinder head, de carbonizing. Practice on Carbureted systems, Electronic fuel injection systems, Exhaust systems. Practice on Petrol engine Air cleaners and intake manifold	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 Petrol Engine Basics: 4-stroke spark-ignition engines- Basic 4-stroke principles, 4-stroke engine cycle. 2-stroke principles, 2-stroke engine cycle, Spark-ignition engine components- Basic engine components, 4 & 2-stroke engine differences, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components. Intake & exhaust systems.
2	Simple repairs in fuel feed system Practice on Cleaning fuel tank, checking for leaks in Fuel tank. Identification of various components of MPFI system.	Gasoline Fuel Systems : Description of Gasoline fuel, Gasoline fuel characteristics, Controlling fuel burn, Stoichiometric ratio, Air density, Fuel supply system, Pressure & vacuum Carburetor operation- Carburetion, Carburetor systems, Metering jets, Accelerating, Carburetor barrels Carbureted system components The carburetor, Mechanical fuel pumps, Electric fuel pumps, Tanks & lines, Fuel lines, Charcoal canister, Carburetor filters. Introduction to Electronic fuel injection (EFI) fuel supply system ,Basic EFI principles, Air supply, Air volume, Multi-point injection systems (MPI/MPFI), Simultaneous injection, Efficient combustion EFI fuel supply system components - Fuel pumps, Fuel filters, Tanks & lines, Fuel lines, Fuel rail, Fuel pressure regulator, Injectors, Tachometric relay, Thermo time switch, EFI sensors, Potentiometer, Auxiliary air valves, Idle speed control devices, Inertia sensors.
3	Identification of Electronic control Unit. Set up for testing,	Introduction to EFI Engine Management -EFI operation Modes of EFI, Electronic fuel

	Identification of various sensors installed in engine & its mounting.	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,
4	Identification and of checking ignition system Practice on checking spark plug, spark plug gap, spark plug cleaning. Checking a charging system Inspecting & adjusting an engine drive belt,	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 Charging system- The purpose of Charging system, charging system components, charging system circuit, Alternator principles, Alternating current, Alternator components, Rectification, Phase winding connections, Rotor circuit, Voltage regulation, System operating voltage, High voltage charging systems, Rotor, Stator, Alternator end frames, Slip ring & brush assembly, Rectifier assembly, Alternator cooling fan.
5-6	Identification of Air conditioning components. Checking a heating system, Identify Abnormal noise from compressor, Remove and install wiper motors and wiper switches. Checking & replacing wiper blades. Check horn for proper functioning. Remove and install new horn	Heating Ventilation Air Conditioning (HVAC) legislation, Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity Description and function of Fixed orifice, Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air-conditioning compressors, Condensers & evaporators, Receiver drier, Lines & hoses, TX

		valve construction, Temperature monitoring thermostat, Refrigerants, Pressure switches, Heating elements Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems. Accessories: Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door lock circuit, remote keyless entry system circuit.
7	Practice on adjusting clutch pedal play Checking and Changing oil in gear box. Identifying noises from gear boxes and rectifying. Identify basic layout of Front-wheel drive, Rear-wheel drive, Four-wheel drive, All-wheel drive	Clutches & Manual Transmissions Clutch components- Pressure plate, Driven/ center plate, Throw-out bearing. Manual transmissions- Gear ratios, Compound gear trains, Gear selection, Bearings, Oil seals & gaskets, Brief about Automated Manual Transmission (AMT) Gearbox layout & operation- Gearbox layouts. Gear shift mechanism. 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 All-wheel drive
8	Identification of Automatic transmission components	Automatic Transmissions - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches. Planetary gearing Electronic control transmission Continuously variable transmission (C.V.T.)-.
9	Identify components of Steering system. Practice on steering geometry components.	Steering Systems:-Description and function of Steering systems, Principles of steering, Steering Gear boxes. 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:-
10	Practice on visual Inspection of chassis frame for crack, bent and twists. Inspection of shackle, leaf spring, front & rear suspension. Lubricating a suspension system. Identify Components of Air Suspension system	Suspension Systems:- Principles of suspension, Suspension force, Unsprung weight, Wheel unit location, Dampening. Types of suspension-Suspension systems, Solid axle, Dead axle 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- Front suspension types & components- Mcpherson Strut suspension, Short/long arm suspension, Torsion bar suspension Rear suspension types & components- Air Suspension System, Types, Parts, Construction and working.
11	Practice on removing wheels from light & Heavy vehicle, dismantling tyres and tubes checking puncture. Assembling and inflating to correct pressure. Rotating the wheels in vehicle minor repairs to wheels and tyres. Checking for tyre wear patterns.	Wheels & Tyres-Wheel types & sizes Wheels, Rim sizes & designations, Types of wheels Tyre types & characteristics. Tyre construction, Types of 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
12	Practice on Adjusting brake pedal play. Bleeding hydraulic brakes & Disk brakes.	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 Drum brakes & components

		Disc brakes & components Antilock braking system & components The construction and operation of heavy vehicle Anti-Slip Regulation / Traction Control (ASR) system
13	Identify antitheft system. Identify location of airbags in vehicles. Practice on Identifying Proximity sensor, Parking sensor, crash sensor, Rain and Light sensor Practice on identifying components of CNG and LPG system Identify different location of various ECUs in vehicle.	Antitheft system, immobilizer system. Navigation system, Car radio and cassette player, car videos. Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre-tensioners, Tire pressure monitoring systems Integrated communications, Proximity sensors, Reflective displays, Global positioning satellites, Triangulation/trilateration, Telemetric. Networking & multiplexing Introduction, function and advantages of parking sensor, crash sensor, Rain and Light sensor, Car immobilizer system Introduction to C.N.G and L.P.G. and Biofuels Its uses and advantages. Modern CNG systems like Gas Injection ECU Communications- Communication between different ECUs. LIN Bus, MOST Bus, CAN Bus.
	Assessment/Examination 03days	

9.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1) **Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2) **Applicability**	**:**	ATS- Mandatory for fresher only
3) **Hours of Instruction**	**:**	**110 Hrs.**
4) **Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5) **Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

9.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**Speaking / Spoken English** Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**Computer Operating System** Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication.	

	Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body - language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Case study/Exercise	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
3	**Motivational Training** Characteristics Essential to Achieving Success The Power of Positive Attitude Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** **Organizational Behavior** Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

Block–II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**10**
1	**Concept of Entrepreneurship** **Entrepreneurship**- Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**Institutions Support** Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**Comparison with developed countries** Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**10**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	
2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	

3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision legislation of India. of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.	
	Quality Tools	**5**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**Quality Circles :** Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	
	Leadership and Team Building skills.	**5**
	Leadership Discipline and Morale Team Work Case Study/ Exercise	
	Meet the Mentor **Role - play as a Supervisor**	**5**
	Organizing and Planning.	**5**
	Time Management Group Dynamics Case Study/ Exercise	

9.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I&II)
DURATION: 18 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** :**MECHANIC MOTOR VEHICLE**

2) **Duration of On-Job Training** : As per Apprenticeship Act amended time to time.

3) **Batch size** : 20

4) **Examination** : i) The assessment/examination will be held on completion of each block

ii) NCVT exam will be conducted at the end of 2nd year.

5) **Instructor Qualification** :

i) Degree/Diploma in Automobile/Mechanical Engg.from recognized university/Board with one/two year post qualification experience in the relevant field and should possess valid LMV driving license.

OR

ii) NTC/NAC in the trade of MMV with three year post qualification experience in the relevant field and should possess valid LMV driving license.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

6) **Tools, Equipments & Machinery required** : - As per Annexure – II

9.2.1 DETAIL SYLLABUS OF PROFESSIONAL SKILL& PROFESSIONAL KNOWLEDGE

Block – I
On-Job Training

Week No	Professional Skill	Professional Knowledge
1	Familiarization with the industry. **Health, Safety & Environment:** Introduction to safety Equipments and their uses. Demonstration of 5S Concept on shop floor. Use of Personal protective Equipments (PPE).	Importance of safety and general precautions observed in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of industry system, stores procedures. Introduction of First aid, operation of electrical mains. Behaviour based safety, unsafe act & situations.
2-3	Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers. 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. Measuring practice on valve spring free length. Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges	Explain systems of measurement, Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier calipers,
4-6	Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges. Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge. Practice to check engine manifold vacuum with vacuum gauge. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting.	Explain Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.
7-8	Checking a charging system for the cause of undercharge, No charge, and over charge	Explain charging system.

	conditions. Removing & replacing an alternator, 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.	Explain procedure of replacing alternator
9	Removing starter motor from vehicle, and Performance test for pull-in test, Hold-in test, pinion (plunger) return test, No-load performance test. Solenoid test for Hold in coil open circuit, Armature test – Ground test, Open circuit test, pull-in coil open circuit test, field coil test. Inspections of brush length wear as per service manual. Trouble shooting , possible causes and remedy for starter motor not running, Starting motor running but too slow (small torque), staring motor running, but not cranking engine. Noise, starting motor does not stop running. Growler testing for rotors. Checking a starting system, Jump-starting a vehicle	Explain starting system. Explain working of growler machine and its working
10	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	Explain lightning circuit. Explain Head light beam aligner and its working
11-12	Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, Practice on removing rocker arm assemblymanifolds.	Explanation of Cylinder Head assembly Procedures
13-14	Practice on removing the valves and its parts from the cylinder head, cleaning & decarburizing. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide– Replacing the valve if necessary. Testing leaks of valve seats for leakage– Dismantle rocker shaft assembly-clean & check rocker shaft-and levers, for wear and cracks and reassemble. Check valve springs, tappets , pushrods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after decarburizing	Valves & Valve Trains- Explain valve operating mechanism and its components

15-16	Overhauling piston and connecting rod Assembly. Use of service manual for clearance and other parameters:- Practice on removing oil sump and oil pump – clean the sump. Practice on removing the big end bearing, connecting rod with the piston. 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. 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. Check connecting rod for bend and twist. Assemble the piston and connecting rod assembly.	Explain different types of pistons, piston rings and piston pins and recommended clearances for the rings and its necessity precautions while fitting rings, common troubles and remedy. Describe function of connecting rod, importance of big- end split obliquely
17-18	Overhauling of crankshaft, Use of service manual for clearance and other parameters:- Practice on removing damper pulley, timing gear/timing chain, flywheel, main bearing caps ,bearing shells and crankshaft from engine checkingoilretainerandthrustsurfacesforwear,Measurecrankshaftjournalforwear, taper and ovality, Checking crankshaft for fillet radii, bend & twist.	Explain function of Crankshaft, camshaft, Engine bearings- classification and location, Firing order of the engine.
19-20	Checking of flywheel and mounting flanges, spigot, bearing. Check vibration damper for defects, Practice on removing camshaft from engine block, Check for bend & twist of camshaft. Inspection of cam lobe, camshaft journals and bearings and measure cam lobe lift. Fixing bearing inserts in cylinder block & cap check nip and spread clearance& oil holes & locating lugs fix crankshaft 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 flywheel and vibration damper. Crankcase & oil pump, gears timing mark, Chain sprockets, chain tensioners etc. Function of clutch & coupling units attached to flywheel
21-22	Cleaning and Checking of cylinder blocks Surface for any crack, flatness, Measure cylinder bore for taper & ovality, clean oil gallery passage and oil pipeline, Bore-descale water passages and examine Removing cylinder liners from scrap cylinder block, practice in measuring and refitting new liners as per maker's recommendations, precautions while fitting new liners.	Description of Cylinder block, Cylinder block construction, and Different type of Cylinder sleeves (liner).
23-24	Reassembleallpartsofengineincorrectsequenceandtorqueallboltsandnutsas per workshop manual	Engine assembly procedure with aid of special tools and gauges used for engine assembling.

	of the engine. Engine component procedures- Testing cylinder compression, Checking idles peed, Removing &replacingcam belt, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt.	
25	Practice on Checking & Top up coolant, Draining & refilling coolant, Checking / replacing a coolant hose, Testing cooling system pressure, Practice on Removing & replacing radiator/thermostat. Inspect the radiator pressure cap, Testing of thermostat. Cleaning &reverse flushing. Overhauling water pump and refitting.	Explain Need for Cooling systems- Basic cooling system components
26-27	Practice on Checking engine oil, Draining engine oil, Replacing oil filter, Refilling engine oil. Overhauling of oil pump, oil coolers, air cleaners and air filters and adjust oil pressure relief valves, repairs to oil flow pipe lines and unions if necessary	Explain lubrication system, Functions of oil, Viscosityand its grade as per SAE, Oil additives, Synthetic oils,
28-29	Practice on Dismantling air compressor and exhauster and cleaning all parts-measuring wear in the cylinder, reassembling all parts and fitting them in the engine. Dismantling &assembling of turbocharger, check for axial clearance as per service manual. Check Exhaust system for rubber mounting for damage, deterioration and out of position; for leakage, loose connection, dent and damage; Practice on Exhaust manifold removal and installation. Practice on Catalytic converter removal and installation.	Explain Intake & exhaust systems– Explain Diesel induction &Exhaust systems. Intake system components- Explain function of Air cleaners, Different type air cleaner, Intake manifolds and material, Explain Exhaust system components- Explain function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers- Reactive, absorptive, Combination., Catalyticconverters, Flexible connections, Ceramic coatings, Back-pressure, Electronic mufflers.
30-32	Practice on removing & Cleaning fuel tanks, checking leaks in the fuel lines, Soldering& repairing pipe lines and Unions, brazing nipples to high pressure line studying the fuel feed system in diesel engines, draining of water separators. Bleeding of air from the fuel lines, Servicing primary &secondary filters. General maintenance of Fuel Injection Pumps (FIP). Removing a fuel injection pump from an engine-refit the pump to the engine re- set timing-fill lubricating-oil start and adjust slow speed of the engine. Practice on overhauling of injectors and testing of injector.	Explain Diesel Fuel Systems- Explain functions of Diesel fuel injection, concept of Quiet diesel technology &Clean diesel technology. Explain Diesel fuel system components Explain Electronic Diesel control-Electronic Diesel control systems, (CRDI) system, (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.
33-34	Practice on Start engine adjust idling	Explain Different Types Marine &Stationary

	Speed and damping device n pneumatic governor and venture control unit checking Performance of engine with offload adjusting timings. Start engine-adjusting Idle speed of the engine fitted with mechanical governor checking-high speed operation of the engine. Checking performance for missing cylinder by isolating defective injectors and test- dismantle and replace defective parts and reassemble and refit back to the engine	Engine
35-36	Monitoring emissions procedures by use of Engine gas analyzer or Diesel smoke meter. Checking & cleaning a Positive crank case ventilation (PCV) valve. Obtaining & interpreting Scan tool data. Inspection of EVAP canister purges system by use of scan Tool. EGR /SCR Valve Remove and installation for inspection.	Explain Emission Control:- Vehicle emissions Standards- Euro and Bhart II, III, IV, V Sources of emission, Types of emissions: Characteristics and Effect exhaust gases, Explain Selective Catalytic Reduction (SCR), EGR VS SCR
37-38	**Revision**	
39	**Assessment/Examination**	

Block – II
On-Job Training

Week No	Professional Skill	Professional Knowledge
1-2	Simple repairs in fuel feed system – overhauling of fuel pump, carburetors, fuel Filters and air cleaners. Repair to a car carburetors – adjusting float level and slow speed adjustments – studying the fuel flow circuit in carburetor Practice in engine tune up in a vehicle – testing vacuum and compression of engine,	Explain carburetor settings. Explain engine tune-up procedures. Explain vacuum and compression testing.
3-5	Practice on Cleaning fuel tank, checking for leaks in Fuel tank. Identification of various components of MPFI system. Testing of MPFI components and replacement if necessary. Check delivery from fuel Pump. Replacing a fuel filter.	Explain various components of MPFI system
6-8	Identification of Electronic control Unit. Set up for testing, Testing of Electronic Control Circuit. Fault finding in Electronic circuit and remedies using scan tool. Identification of various sensors installed in engine & its mounting. Checking instruments & Gauges on dash board. Rectify replace defective gauges. Testing of Temperature sensor, Pressure senor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor.	Explain importance of Electronic control Unit. Describe scan tool.
9-11	Identification of Air conditioning components, Performance test on A/c unit, Checking Charged state of refrigerant, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt. Checking a heating system, Compressor rotation test, air Gap check, Refrigerant recovery –evacuating –charging of A/c system. Replenishing compressor oil level. Troubles diagnose and remedy for No cooling or warm air, Cool air comes out only intermittently, Insufficient cooling, Abnormal noise from compressor, Magnetic clutch, condenser, evaporator, Blower motor. Diagnosis test for High pressure gauge –pressure high and low, Low pressure gauge for pressure high and low.	Describe Air conditioning System/HVAC. Explain use of AC Gas Charging machine and its maintenance.
12-13	Remove and install wiper motors and wiper	Explain wiper system working,

	switches. Trouble shooting and remedy for windshield wiper and washer - no operation, intermittent operation, continuous operation, and wipers will not park. Diagnose causes for improper operation of the windshield washer system and to replace the pump if faulty. Diagnose the power window system for – all power window motors do not operate, some switches do not operate. Diagnose the power door lock control for – All power door locks do not operate, only one power door lock not operate. Diagnose for remote keyless entry and immobilizer system. Familiarization of car radio wiring and speaker circuits Diagnose automatic seat belt systems, Diagnose air bag system and service warnings.	Explain Power window. Describe Immobilizer system and keyless entry.
14-16	Practice on adjusting clutch pedal play-removing gearbox and clutch assembly from Light & Heavy Vehicle. Dismantling clutch assembly, cleaning inspecting parts. 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. Assembling of pressure plate adjusting the fingers checking run out of fly wheel and aligning clutch assembly with flywheel. Dismantling cleaning and assembling of gearshift mechanism changing oil in gear box. 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.	Describe Clutches & Manual Transmissions- Explain Manual transmissions- and Automated Manual Transmission (AMT) Describe Gearbox layout & operation-
17-18	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 special precautions while removing torque tube drive shaft. Practice on FWD Driveshaft Removal and Replacement. Practice on overhauling & inspection of rear axle. Practice on overhauling & inspection of differential assembly. Trouble shooting – causes and remedy for clutch slip, clutch noise, clutch binding, hard clutch,	Explain Final Drive & Drive Shafts Basic layouts Explain Rear-wheel drive Explain Four-wheel drive and All-wheel drive

	gearbox noise, gear slip, rear axle noise, propeller shaft noise, universal joint noise, differential noise.	
19	Changing transmission fluid & filter. Practice on oil pressure control cable play adjustments, Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler.	Explain Automatic Transmissions – Explain Electronic control transmission– Explain Continuously variable transmission (C.V.T.)
20-21	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. Practice on removing steering wheel, steering gearbox. Inspect and overhaul steering boxes, adjusting steering gear backlash, pre-load and adjust toe-in, toe-out, camber angle, castor angle, kingpin inclination and wheel run out. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system, Inspecting & adjusting an engine drive belt, Servicing a steering system, Servicing wheel bearings. Troubleshooting- Causes and remedy for abnormal wear of tyre, wheel wobbling, poor self centering, hard steering, and vehicle pulling to one side.	Describe Steering Systems and Steering boxes & columns Explain Steering arms & components Describe Wheel alignment fundamentals
22-23	Overhauling of shackle, leaf spring, front & rear suspension. Practice on removing, inspection and assembling of shock absorber 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".	Describe Suspension Systems and Types of suspension Explain Shock absorber. Describe Front and rear suspension types & components
24	Practice on removing wheels from vehicle, dismantling tyres and tubes checking puncture. Assembling inflating to correct pressure. Rotating the wheels in vehicle minor repairs to wheels and tyres, wheel balancing & alignment. Checking for tyre wear patterns.	Describe Wheels & Tyres-Wheel types & sizes Wheels, Rim sizes & designations, Types of wheels Explain Tyre types & characteristics and Tyre construction
25-27	Practice on Adjusting brake pedal play, Overhauling and inspection of tandem master cylinder assembly, Overhauling and inspection of front and rear	Explain Types of brakes and Braking system components Describe Antilock braking system & components

	brake assembly, overhauling and inspection of wheel cylinder assembly. Bleeding hydraulic brakes & Disk brakes. Overhauling and inspection of vacuum assisted brake assembly. Overhauling and inspection of disc brake. Adjusting Air brakes- repair to tank unit, air compressor, wheel brake adjuster- locating air leaks in the brake lines and rectifying – general maintenance and care. Brakes 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. Trouble tracing in braking system of a heavy vehicle adjusting brakes and balancing all four wheel brakes, precautions to be observed while testing brakes points to be remember while preparing the vehicle for brake certificate. Practice of maintaining of ABS system.	
28	Identify various components of Hybrid vehicles. Check Traction Motor for Proper Functioning.	Introduction of Hybrid Vehicles, Types, Advantages, Construction
29	Check Air bellows for leak, cut and wear. Check antiroll bar and lubricate. Check level sensor for proper functioning. Check airlines for leakage and damages. Braze or replace if faulty. Check faults using HMI (Human Machine Interface system).	Explain Air Suspension System, Types, Parts, Construction and working. Explain HMI-Human Machine Interface, Advantages, Uses and working.
30	Perform Preventive, Periodic and Condition Based Maintenance on vehicles. Pre Delivery Inspection. Warranty Repairs	Explain Maintenance-Its importance in Productivity, types. Describe Preventive maintenance-objective and function of preventive maintenance. Section inspection. Visual and detailed
31-33	Driving Practice. Practice in straight driving on wide roads. Driving through lanes and curves. Practice in reversing. Practice overtakinganother vehicle. Practice in driving through sand and wet surfaces. Practice in parking and Diagonal parking. Trace, Diagnose and trouble shoot faults.	Study of Motor Vehicle act Rules & Regulation-Laws governing to use of motor vehicle & vehicle transport, Licensing of drivers & conductors, Registration of vehicle, Traffic rules, Signals & controls, Accidents, Causes & analysis, Responsibility of driver, Offences, penalties & procedures, Different types of forms, Government administration structure, Personnel, Authorities & duties, Rules regarding construction of motor vehicles, Tax exemption & tax renewal, Insurance types & significance -Comprehensive

		Third party insurance, Duty of driver in case of accident Locating vehicle information, Obtaining & interpreting scan tool data, Using a repair manual, Using a shop manual, Using an owner's manual, Using a labor guide, Using a parts program, Using a service information program
34-35	**Project Work(Work in team)**	
36-37	**Revision**	
38-39	**NCVT Examination**	

10. ASSESSMENT STANDARD

10.1 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 to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a)Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

b)Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

c)Weightage in the range of above 90% to be allotted during assessment under following performance level:

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.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line 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

10.2 INTERNAL ASSESSMENTS (FORMATIVE ASSESSMENT)

COMP. NO.	COMPETENCY	INTERNAL MARKS
	GENERIC COMPETENCIES (Applicable to each Block)	
1.	Recognize & comply safe working practices, environment regulation and housekeeping.	
2.	Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	
3.	Illustrate concept and principles of basic arithmetic calculation, algebraic, trigonometric, statistics and apply knowledge of specific area to perform practical operations which requires well developed skills.	
4.	Explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	
5.	Read and apply engineering drawing for different application in the field of work.	
6.	Explain the knowledge of general concept, principles of productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	
7.	Explain the general concept and process of energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	
8.	Explain and display sensitivity towards personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	
9.	Apply the general concept of basic computer, basic operating system and uses of internet services to take benefit of IT developments in the industry.	
	SPECIFIC COMPETENCIES	
10.	Plan & perform basic fastening & fitting operations of various parts of vehicle using various tools and equipment observing standard procedure used in automotive workshop.	
11.	Trace and Test Electrical and Electronic Components and Circuits	

	and assemble to ensure functionality of system	
12.	Overhaul Charging and Starting System of vehicle as per standard procedure and check functioning of system.	
13.	Repair/ replace the defective gauges fitted on dashboard and check engine performance.	
14.	Overhaul and service Diesel Engine, its parts as per standard procedure, analyze engine and check functionality.	
15.	Service Diesel Fuel System as per manufactures guidelines and check proper functioning.	
16.	Analyze and adjust Engine Emissions Control Systems.	
	SUB TOTAL FOR BLOCK I	**250**
17.	Plan and overhaul the Petrol Engine, check functionality and analyze to perform engine tune up.	
18.	Test functionality of Multi Point Fuel Injection Components and Electronic Components of Petrol Vehicle and analyze to repair/ replace defective gauges.	
19.	Overhaul and Service the Air Conditioning system Components, Air Conditioning and check functionality of system.	
20.	Perform Service and Overhauling of transmission system, test system and analyze test report for proper functioning.	
21.	Carryout overhauling of light /Heavy vehicle chassis system including steering, suspension and braking system as per standard procedure and check functionality.	
22.	Carry out removal, repair and fitting, wheel balancing activities of tyres and tubes of light & Heavy vehicle as per standard procedure.	
23.	Diagnose and troubleshoot the electrical system accessories of vehicle.	
24.	Drive, diagnose and trouble shoot faults in the vehicle.	
	SUB TOTAL FOR BLOCK II	**250**
	TOTAL INTERNAL MARKS	**500**

10.3 FINAL ASSESSMENT- ALL INDIA TRADE TEST(SUMMATIVE ASSESSMENT)

	SUBJECTS	Marks	Internal assessment based on competency	Full Marks	Pass Marks	Duration of Exam.
Block – I & II	**Block - I**		**250**	**250**	**150**	
	Professional Skill	250		250	150	**08 hrs.**
	Professional Knowledge	100		100	40	3 hrs.
	Workshop Cal. & Sc.	50		50	20	3 hrs.
	Engineering Drawing	50		50	20	4 hrs.
	Employability Skill	50		50	20	3 hrs.
	Block - II		**250**	**250**	**150**	
	TOTAL for Block – I & II	**500**	**500**	**1000**	**550**	
	Grand Total		**500**			

Marks Distribution TOTAL: 1000 marks for I & II Blocks Pass marks: 550

Note: - The candidate pass in each subject conducted under all India trade test.

11. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (Lateral entry).
- On successful completion of the course trainees can opt for CITS course.

Employment opportunities:

On successful completion of this course, the candidates shall be gainfully employed in the following industries:

1. Auto Fitter in Manufacturing Concern in Assembly Shop or Test Shop
2. Mechanic in Auto Manufacturing Industry
3. Dealers service mechanic
4. Driver/Vehicle Operator
5. Spare Parts Sales Assistant /Manufacturers' Representative
6. Self-Employment

12. LIST OF EXPERT MEMBERS

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Expert Group Designation
1.	Jayant Krishna Principal Consultant	M/S TATA Consultancy Service Ltd., Lucknow	Chairman
2.	T. C. Saravanabava	DDG(AT), MSDE	Member
3.	Sandhya Salwan	Director (AT), MSDE	Member
4.	Satya Shankar B. P.	Director, CSTARI, Kolkata	Member
5.	VivekMehrotra AGM (HR)	TATA Motors Ltd., Lucknow	Group Leader
6.	NirmalyaNath Asstt. Director (Trg.)	CSTARI, Kolkata	Member
7.	AkhileshPandey Trg. Officer	ATI, Mumbai	Member
8.	T. K. Rudra Trg. Officer	ATI, Kolkata	Addnl. Member
9.	S. Bandyopadhyay Trg. Officer	ATI, Kolkata	Addnl. Member
10.	Sanjay Srivastava Officer,Training Centre,	Tata Motor Lucknow	Addnl. Member

ANNEXURE – I

TOOLS & EQUIPMENT FOR - BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: MMV

LIST OF TOOLS & EQUIPMENTS FOR -20APPRENTICES

A.TRAINEES TOOL KIT: -

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

B. TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Item with specification	Quantity (indicative)
19.	AC alternator slip ring puller	1
20.	Adjustable spanner (pipe wrench 350 mm)	2
21.	Air blow gun	1
22.	Air impact wrench	1
23.	Air ratchet	1
24.	Allen Key set of 12 pieces (2mm to 14mm)	2
25.	Alternator assembly used for LMV	2
26.	Ammeter 300A/ 60A DC with external shunt	2
27.	Angle plate adjustable 250x150x175	1
28.	Anvil 50 Kgs with Stand	1
29.	Battery –charger	2
30.	Belt Tensioner gauge	1
31.	Blow Lamp 1 litre	2
32.	Caliper inside 15 cm Spring	2
33.	Calipers outside 15 cm spring	2
34.	Carburetor – Solex, Mikuny for dismantling and assembling	1 each
35.	Carburetor repair tool kit	1
36.	Chain Pulley Block-3 ton capacity	1
37.	Chisel 10 cm flat	2
38.	Chisels cross cut 200 mm X 6mm	2
39.	Circlip pliers Expanding and contracting type 15cm and 20cm each	2
40.	Clamps C 150mm	2
41.	Cleaning tray 45x30 cm.	4
42.	Compression testing gauge suitable for diesel Engine	2
43.	Connecting rod alignment fixture	1
44.	Constant Mesh Gear box with stand for Dismantling and assembly.	1
45.	Copper bit soldering iron 0.25 Kg	2
46.	Cut section Model of Mock layout of a motor car –electrical system working model	1 set
47.	Cut section models of shock absorbers	1
48.	Cut section of cross ply and radial tyres	1
49.	Cylinder bore gauge capacity 20 to 160 mm	2

50.	Cylinder liner- Dry & wet liner, press fit & slidefit liner	1 each
51.	DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms	2
52.	Depth micrometer 0-25mm	4
53.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)	4
54.	Different type of Engine Bearing model	1 set
55.	Different type of piston model	1each
56.	Direct reading vernier caliper B 300 (direct reading with dial)	1
57.	Disk brake with caliper assembly	2
58.	Distributor –Duel advance type, reluctance type	1 each
59.	Dividers 15 cm Spring	2
60.	Drift Punch Copper 15 Cm	4
61.	Drill point angle gauge	1
62.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4
63.	Drum brake assembly	1
64.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
65.	Electric testing screw driver	2
66.	Electrical horn (different types)	2
67.	Electronic engine control module	1
68.	Engineer's square 15 cm. Blade	2
69.	Executive Auto Electrical tool kit	1
70.	Feeler gauge 20 blades (metric)	2
71.	File flat 20 cm bastard	4
72.	File, half round 20 cm second cut	4
73.	File, Square 20 cm second cut	4
74.	File, Square 30 cm round	4
75.	File, triangular 15 cm second cut	4
76.	Flat File 35 cm bastard	4
77.	Front axle (Rzeeppa Joint) with stand for Dismantling and assembly	1
78.	Fuel feed pump	1
79.	Fuel injection pump (Diesel) inline	1
80.	Gloves for Welding (Leather and Asbestos)	5 sets
81.	Granite surface plate 1600 x 1000 with stand and cover	1
82.	Grease Gun	2
83.	Growler	1

84.	Hacksaw frame adjustable 20-30 cm	10
85.	Hammer Ball Peen 0.75 Kg	2
86.	Hammer copper 1 Kg with handle	2
87.	Hammer Plastic	2
88.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2
89.	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
90.	Hand rubber gloves tested for 5000 V	5 pair
91.	Hand Shear Universal 250mm	2
92.	Hand vice – 37 mm	2
93.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
94.	Horn and Horn relay	2
95.	Injector – Multi hole type, Pintle type	4 each
96.	Injector cleaning unit	1
97.	Diesel Injector testing set (Hand tester)	1
98.	Insulated Screw driver 20 cm x 9mm blade	8
99.	Insulated Screw driver 30 cm x 9mm blade	8
100.	Left cut snips 250mm	4
101.	Lifting jack screw type 3 ton capacity	4
102.	Magneto spanner set with 8 spanners	1 set
103.	Magnifying glass 75mm	4
104.	Marking out table 90X60X90 cm.	1
105.	Multimeter digital	5
106.	Multi-point fuel injection pump	1
107.	Oil can 0.5/0.25 liter capacity	2
108.	Oil pump for dismantling and assembling.	2
109.	Oil Stone 15 cm x 5 cm x 2.5 cm	1
110.	Outside micrometer 0 to 25 mm	1
111.	Outside micrometer 25 to 50 mm	4
112.	Outside micrometer 50 to 75 mm	1
113.	Petrol nozzle	4
114.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	8
115.	Pipe cutting tool	2
116.	Pipe flaring tool	2

117.	Piston ring compressor	2
118.	Piston Ring expander and remover.	2
119.	Piston Ring groove cleaner.	1
120.	Pliers combination 20 cm.	2
121.	Pliers flat nose 15 cm	2
122.	Pliers round nose 15 cm	2
123.	Pliers side cutting 15 cm	2
124.	Portable electric drill Machine	1
125.	Prick Punch 15 cm	4
126.	Punch Letter 4mm	2 set
127.	Radiator cut section-cross flow	1
128.	Radiator cut section-down flow	1
129.	Radiator pressure cap	2
130.	Right cut snips 250mm	4
131.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm	4
132.	Scraper flat 25 cm	2
133.	Scraper half round 25 cm	2
134.	Scraper Triangular 25 cm	2
135.	Scriber 15 cm	2
136.	Scriber with scribing black universal	2
137.	Set of stock and dies - UNC, UNF and metric	2 sets
138.	Sheet Metal Gauge	2
139.	Sliding mesh Gear box with stand for Dismantling and assembly.	2
140.	Soldering Copper Hatchet type 500gms	5
141.	Solid Parallels in pairs (Different size) in Metric	2
142.	Spanner Clyburn 15 cm	1
143.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
144.	Spanner T. flocks for screwing up and up-screwing inaccessible positions	2
145.	Spanner, adjustable 15cm.	2
146.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	2
147.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	2
148.	Spark plug spanner 14mm x 18mm x Size	2
149.	Steel measuring tape 10 meter in a case	2

150.	Steel rule 15 cm inch and metric	2
151.	Steel rule 30 cm inch and metric	2
152.	Straight edge gauge 2 ft.	1
153.	Straight edge gauge 4 ft.	1
154.	Stud extractor set of 3	2 sets
155.	Stud remover with socket handle	1
156.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	2
157.	Synchronous Gear box with stand for Dismantling and assembly.	1
158.	Tachometer (Counting type)	1
159.	Tandem master cylinder with booster	2
160.	Taps and Dies complete sets (5 types)	1 set
161.	Taps and wrenches - UNC, UNF and metric	2 sets
162.	Telescope gauge	4
163.	Temperature gauge with sensor 0-100 deg c	2
164.	Tester sparking plug 'NEON' Type	1
165.	Thermostat	2
166.	Thread pitch gauge metric, BSW	1
167.	Timing lighter	1
168.	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
169.	Trammel 30 cm	2
170.	Tread wear indicator	1
171.	Tubed tyre of car, trucks & motorcycle	1
172.	Tubeless tyre of cars & trucks	1
173.	Turbocharger cut sectional view	1
174.	Tyre& split rim wheel assembly	1
175.	Tyre pressure gauge with holding nipple	2
176.	Universal puller for removing pulleys, bearings	1
177.	V' Block 75 x 38 mm pair with Clamps	2
178.	Vacuum assisted hydraulics brake assembly with vacuum booster	1
179.	Vacuum gauge to read 0 to 760 mm of Hg.	2
180.	Valve Lifter	1
181.	Valve spring compressor universal.	1
182.	Vernier caliper 0-300 with inside and depth measurement	4
183.	Vice grip pliers	2

184.	Water pump for dismantling and assembling	2
185.	Wheel cylinder	4
186.	Wiper motor assembly	2
187.	Wire Gauge (metric)	5
188.	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	1
189.	4 Point relays	2
190.	5 Point relays	2

C. GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Item with specification	Quantity (indicative)
1	Air conditioned MPFI vehicle with accessories	1
2	Arbor press hand operated 2 ton capacity	1
3	CRDI Vehicle in running condition	1
4	Diesel Engine – 2 stroke for Dismantling and assembling with swiveling stand	2
5	Drilling machine bench to drill up to 12mm dia along with accessories	1
6	Gas Welding Table 1220mm x760mm	2
7	Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth	1
8	Heavy Commercial vehicle **(Optional/Old)**	1
9	Hydraulic jack HI-LIFT type -3 ton capacity,	1
10	Multi Scan Tool with oscilloscope **(Optional)**	1
11	Petrol Engine(2-stroke) Motor Cycle/Scooter along with special tools and accessories	1
12	Battery Charger 12v	1
13	Tin smiths bench folder 600 x 1.6mm	1
14	Transfer case with stand for Dismantling and assembly **(Optional/Old)**	1
15	Trolley type portable air compressor single cylinder with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm	1
16	Tube/ tyre vulcanizing machine	1
17	Tubeless tyre repair kit	
18	Tyer Changer Machine **(Optional)**	1
19	Ultrasonic Injection cleaning equipment**(Optional)**	1
20	Welding plant Oxy-Acetylene complete (high pressure)	2

21	Welding Transformer (200 to 400 Amps)	2
22	Wheel alignment Machine**(Optional)**	1
23	Wheel balancing machine **(Optional)**	1
24	Working Condition of Petrol MPFI Engine Assembly with fault simulation board**(Optional)**	1

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MMV

LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

1) **Space Norms** : 45 Sq.m.(For Engineering Drawing)

2)A : TRAINEES TOOL KIT:-

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

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01
6	White Board (size: 8ft. x 4ft.)	01
7	Trainer's Table	01
8	Trainer's Chair	01

ANNEXURE – II

TOOLS & EQUIPMENT FOR ON-JOB TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

TRADE: MMV

General Installation/Machineries:-

Sl.No.	Name & Description of Machines	Quantity
1.	Air bagsimulator	As required
2.	Air conditionedCRDIVehicleinrunningcondition-LMV	As required
3.	Air conditioningserviceUnit(Car)	As required
4.	Air conditioningtrainerkit	As required
5.	Arborpress hand operated 2 ton capacity	As required
6.	Automotive exhaust 5 gasanalyzer(petrol& Diesel) or Diesel Smoke Meter	As required
7.	Bench lever shears 250mm Bladex3mm Capacity	As required
8.	DieselEngine – CRDI-4 strokeforDismantlingandassemblingwith swiveling stand	As required
9.	Dieselengine(Runningcondition)Stationarytype	As required
10.	DiscreteComponent Trainer/ BasicElectronics Trainer	As required
11.	Drillingmachinebenchtodrilluptol2mmdiaalongwithaccessories	As required
12.	DualMagnetization Yoke: AC / HWDC, 230 VAC, 50Hz	As required
13.	FourstrokepetrolenginewithCNGsetup-workingcondition	As required
14.	GasWeldingTablel220mmx760mm	As required
15.	Grindingmachine(generalpurpose)D.E.pedestalwith 300 mm dia wheelsroughand smooth	As required
16.	HandoperatedHydraulicpress	As required
17.	HeavyCommercialvehicletype(withoutbodyonframe)	As required
18.	Hydraulic jackHI-LIFTtype-3 ton capacity,and5 Ton capacity	As required
19.	LiquidpenetrantInspection kit	As required
20.	MPFIpetrolenginewithswivelingstandalongwithspecial tools for dismantlingand assembling	As required
21.	Multi Scan Tool with oscilloscope	As required
22.	PetrolEngine(2-stroke)Motor Cycle/Scooteralongwith special tools andaccessories	As required
23.	PipeBendingMachine(Hydraulictype)12mmto30mm	As required
24.	Pneumaticrivetgunwithstandardaccessories	As required
25.	Springtensiontester	As required

26.	Tinsmithsbenchfolder600xl.6mm	As required
27.	TransfercasewithstandforDismantlingandassembly.	As required
28.	Trolleytypeportableaircompressorsinglecylinderwith 45 liters capacityAirtank,alongwithaccessories& with workingpressure6.5kg/sq cm	As required
29.	Tube/tyrevulcanizingmachine	As required
30.	Twopostcar lift – capacity4000 kg	As required
3I.	TyerChangerMachine	As required
32.	UltrasonicInjectioncleaningequipment	As required
33.	WeldingplantOxy-Acetylenecomplete (high pressure)	As required
34.	WeldingTransformer(I50-300Amps)	As required
35.	Wheelalignment Machine –computerised 3D	As required
36.	Wheelbalancingmachine	As required
37.	WorkingConditionDieselEngine– CRDI-4 strokeEngine Assemblywith fault simulation board	As required
38.	WorkingCondition of PetrolMPFIEngineAssemblywithfault simulation board	As required

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. All the questions of theory paper for the trade will be in objective type format.

2. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

3. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

4. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.

5. Questions may be set based on following instructions:-

Sl. No.	Question on different aspect	Weightage in %age	Key Words may be like
1	Information received	25	What, Who, When
2	Knowledge	50	Define, Identify, Recall, State, Write, List & Name
3	Understanding	15	Describe, Distinguish, Explain, Interpret & Summarize
4	Application	10	Apply, Compare, Demonstrate, Examine, Solve & Use

6. Due weightage to be given to all the topics under the syllabus while setting the question paper.