MECHANIC MOTOR VEHICLE

NSQF LEVEL - 5

2nd YEAR

TRADE THEORY

SECTOR: Automobile

Directorate General of Training

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

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

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FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of Mentor Councils comprising various stakeholders viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Mechanic Motor Vehicle, 2nd Year Trade Theory - NSQF Level - 5 in Automobile** Sector under yearly Pattern required for ITIs and related institutions imparting skill development. The NSQF Level - 5 will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF Level - 5 trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF Level - 5 will help the trainers and trainees of ITIs, and all stake holders will derive maximum benefits from these Instructional Media Packages IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

RAJESH AGGARWAL
Director General/ Addl.Secretary
Ministry of Skill Development & Entrepreneurship,
Government of India.

New Delhi - 110 001

PREFACE

The National Instructional Media Institute (NIMI) was established in 1986 at Chennai by then Directorate General of Employment and Training (D.G.E & T), Ministry of Labour and Employment, (now under Directorate General of Training, Ministry of Skill Development and Entrepreneurship) Government of India, with technical assistance from the Govt. of Federal Republic of Germany. The prime objective of this Institute is to develop and provide instructional materials for various trades as per the prescribed syllabus under the Craftsman and Apprenticeship Training Schemes.

The instructional materials are created keeping in mind, the main objective of Vocational Training under NCVT/NAC in India, which is to help an individual to master skills to do a job. The instructional materials are generated in the form of Instructional Media Packages (IMPs). An IMP consists of Theory book, Practical book, Test and Assignment book, Instructor Guide, Audio Visual Aid (Wall charts and Transparencies) and other support materials.

The trade practical book consists of series of exercises to be completed by the trainees in the workshop. These exercises are designed to ensure that all the skills in the prescribed syllabus are covered. The trade theory book provides related theoretical knowledge required to enable the trainee to do a job. The test and assignments will enable the instructor to give assignments for the evaluation of the performance of a trainee. The wall charts and video clips are unique, as they not only help the instructor to effectively present a topic but also help him to assess the trainee's understanding. The instructor guide enables the instructor to plan his schedule of instruction, plan the raw material requirements, day to day lessons and demonstrations.

IMPs also deals with the complex skills required to be developed for effective team work. Necessary care has also been taken to include important skill areas of allied trades as prescribed in the syllabus.

The availability of a complete Instructional Media Package in an institute helps both the trainer and management to impart effective training.

The IMPs are the outcome of collective efforts of the staff members of NIMI and the members of the Media Development Committees specially drawn from Public and Private sector industries, various training institutes under the Directorate General of Training (DGT), Government and Private ITIs.

NIMI would like to take this opportunity to convey sincere thanks to the Directors of Employment & Training of various State Governments, Training Departments of Industries both in the Public and Private sectors, Officers of DGT and DGT field institutes, proof readers, individual media developers and coordinators, but for whose active support NIMI would not have been able to bring out this materials.

R. P. DHINGRA
EXECUTIVE DIRECTOR

Chennai - 600 032

ACKNOWLEDGEMENT

National Instructional Media Institute (NIMI) sincerely acknowledges with thanks for the co-operation and contribution extended by the following Media Developers and their sponsoring organisation to bring out this IMP **(Trade Theory)** for the trade of **Mechanic Motor Vehicle** under the **Automobile** Sector for ITIs.

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NIMI records its appreciation of the Data Entry, CAD, DTP Operators for their excellent and devoted services in the process of development of this Instructional Material.

NIMI also acknowledges with thanks, the invaluable efforts rendered by all other staff who have contributed for the development of this Instructional Material.

NIMI is grateful to all others who have directly or indirectly helped in developing this IMP.

INTRODUCTION

TRADE THEORY

The manual of trade theory consists of theoretical information for the Second Year of the Mechanic Motor Vehicle Trade. The contents are sequenced according to the practical exercise contained in the manual on Trade practical. Attempt has been made to relate the theoretical aspects with the skill covered in each exercise to the extent possible. This co-relation is maintained to help the trainees to develop the perceptional capabilities for performing the skills.

The Trade theory has to be taught and learnt along with the corresponding exercise contained in the manual on trade practical. The indicating about the corresponding practical exercise are given in every sheet of this manual.

It will be preferable to teach/learn the trade theory connected to each exercise atleast one class before performing the related skills in the shop floor. The trade theory is to be treated as an integrated part of each exercise.

Module 1	**Transmission System**	225 Hrs
Module 2	**Steering and Suspension System**	200 Hrs
Module 3	**Brake System**	100 Hrs
Module 4	**Motor vehicle act and engine trouble shooting**	50 Hrs
Module 5	**Electronic Control System**	150 Hrs
Module 6	**Charging and Starting System**	100 Hrs
Module 7	**Lighting System**	50 Hrs
Module 8	**Air Conditioning System**	50 Hrs
Module 9	**Electrical components trouble shooting**	50 Hrs
Module 10	**Vehicle information and driving practices**	75 Hrs
	Total	1050 Hrs

The material is not the purpose of self learning and should be considered as supplementary to class room instruction

TRADE PRACTICAL

The trade practical manual is intented to be used in workshop . It consists of a series of practical exercises to be completed by the trainees during the one year course of the Mechanic Motor Vehicle trade supplemented and supported by instructions/ informations to assist in performing the exercises. These exercises are designed to ensure that all the skills in compliance with NSQF LEVEL - 5

The manual is divided into Ten modules. The distribution of time for the practical in the Ten modules are given below.

The skill training in the shop floor is planned through a series of practical exercises centred around some practical project. However, there are few instances where the individual exercise does not form a part of project.

While developing the practical manual a sincere effort was made to prepare each exercise which will be easy to understand and carry out even by below average trainee. However the development team accept that there is a scope for further improvement. NIMI, looks forward to the suggestions from the experienced training faculty for improving the manual.

CONTENTS

LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

- **Plan & perform maintenance, diagnosis and servicing of transmission system.**
- **Plan & perform maintenance, diagnosis and servicing of vehicle control system**
- **Troubleshoot vehicle engine components and ascertain repair**
- **Plan & service electronic control unit and check functionality.**
- **Diagnose & rectify the defects in vehicle to ensure functionality of vehicle.**
- **Carryout overhauling of charging system.**
- **Carryout overhauling of starting system.**
- **Troubleshoot electrical components of vehicle and ascertain repair.**
- **Overhaul, service and testing vehicle air conditioning system, its parts and check functionality.**
- **Drive vehicle following traffic regulations and maintenance of good road conduct**

SYLLABUS

Second Year

Week No.	Learning Outcome Reference	Professional Skills (Trade Practical) with Indicative hrs.	Professional Knowledge (Trade Practical)
53-56	Plan & perform maintenance, diagnosis and servicing of transmission system	92. Identify different major components of Heavy vehicle and their function & placement study of different make lorry/ bus in Institute with different dealers or organizations. (25 Hrs) 93. Practice on adjusting clutch pedal play-removing gearbox and clutch assembly from Light & Heavy Vehicle. (10 Hrs) 94. Perform Dismantling clutch assembly, cleaning inspecting parts. (10 Hrs) 95. Carryout Removing & fitting of new pilot bearing, removing & fitting of ring gear in fly wheel relining a clutch plate, checking condition of flywheel and pressure plate surface for reconditioning. (15 Hrs) 96. Perform Assembling of pressure plate adjusting the fingers checking run out of fly wheel and aligning clutch assembly with flywheel. (10 Hrs) 97. Perform Dismantling cleaning and assembling of gearshift mechanism changing oil in gear box. (15 Hrs) 98.Practice Dismantling a synchromesh gear box, cleaning, inspecting parts replacing worn out defective parts assembling & testing for correct performance identifying noises from gear boxes and rectifying. (15 Hrs) 99. Practice on Removing open type propeller shaft from vehicle, Practice on removing universal joints, cleaning replacing worn out parts, re-assembling & refitting to vehicle- and their alignment, including front wheel drive and all wheel drive of LMV. (15 Hrs)	**Introduction:** Study of different major components & assemblies of heavy vehicle, and different make (indigenous). Name plate-constructional differences and their merits.leading manufacturers in Heavy vehicle Industry **Clutchs &Manual Transmission** Clutch principles, Single-plate clutches, Multi-plate clutches, Dual mass flywheels, Operating mechanisms **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, Transaxle designs, Gearbox operation, Baulk-ring synchromesh unit, Transaxle synchromesh unit. Gear shift mechanism.
57-59	- do -	100.Practice on FWD Driveshaft Removal and Replacement. (15 Hrs) 101. Practice on overhauling & inspection of rear axle. (15 Hrs) 102. Practice on overhauling & inspection of differential assembly. (15 Hrs) 103. Perform Trouble shooting – causes and remedy for clutch slip, clutch noise, clutch binding, hard clutch, gearbox noise, gear slip, rear axle noise, propeller shaft noise, universal joint noise, differential noise. (15 Hrs)	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,Limitedslip differentials.Four-wheel drive- Four-wheel drive shafts, Four-wheel final drive, Four-wheel drive transfer case, Freewheeling hubs, Four-

			wheel drive differentials All-wheel drive- four wheel final drives,All-wheel drive transfer case, Transfer case differential action.
60 - 61	- do -	104.Identify Automatic transmission components (5 Hrs) 105. Check automatic transmission fluid and replace transmission fluid & filter. (20 Hrs) 106. Practice on oil pressure control cable play adjustments, Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler. (25 Hrs)	Automatic Transmissions - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches.Planetary gearing- Planetary gears, Simple planetary gear sets, Compound planetary gear sets, Automatic transmission brake bands, Multi-disc clutches, Electronic control transmission -Electronic control Unit, Fully hydraulically controlled transmission, Electronic shift programs, Manual selection. Layout&operationfor P,R,N&D(1st& 2nd)Selector positions, Planetary gear set, High range power flow, Low range power flow Servos & clutches- Rear One way clutch, Multi-plate front clutch, Clutch pack, Rear clutch.Hydraulic system & controls-Hydraulic system components, Spool valves, Regulating or flow control valves, Control valves, OrificesValve types & functions- Basic valve action, Regulator & control valves, Shift & governor valvesPressure regulation- The primary regulating valve, Line pressure variation, Modulator valve pressure, The governor, Governor pressure, Kick down pressure. Flow control- Gear position 1, 1-2 shift valve, 2-3 shift valve assembly, The servo orifice control valve, 3-2 kick downContinuously variable transmission(C.V.T.)- Continuously variable transmission, Drive or reverse, The steel belt, Secondary pulley shaft.
62 - 64	Plan & perform maintenance, diagnosis and servicing of Vehicle Control System	Following practical to be practiced on Light Heavy &Vehicle. 107. 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. (10 Hrs)	Steering Systems: - Description and function of Steering systems, Principles of steering, Rack-and-pinion steering system, Recirculation ball & nut steering system, Four-wheel steering systems, collapsible steering system.

		108. Practice on removing steering wheel, steering gearbox. (10 Hrs) 109. 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. (10 Hrs) 110. Check & top up power steering fluid, (5 Hrs) 111. Carryout Pressure testing a power steering system, Flushing a power steering system, (10 Hrs) 112. Carryout Inspecting & adjusting an engine drive belt, (5 Hrs)gallery passage and oil pipe line. (05 hrs) 113. Carryout Servicing a steering system, (10 Hrs) 114. Practice servicing wheel bearings. (10 Hrs) 115. Perform Troubleshooting- Causes and remedy for abnormal wear of tyre, wheel wobbling, poor self centring, hard steering, and vehicle pulling to one side. (5 Hrs)	Steering boxes & columns - Description and function of Steering columns, Rack-and-pinion gearbox, Helix, Variable ratio steering, Worm gearbox, Power Assisted steering, Steering process, Flow-control valve, Electric power assisted steering, Basic electric power steering operationSteering arms & components- Forward control vehicle steering, Steering linkages, Joints, Bushes/bushings Wheel alignment fundamentals:- Basic principles of wheel alignment, wheel base, wheel track, king pin inclination, Caster, Camber, Scrub radius, Toe-in & toe out, Toe-out on turns, Turning radius, Thrust angle & centrelines.
65 - 67	- do -	Following practical to be Practiced On Light & Heavy Vehicle 116. Practice on visual Inspection of chassis frame for crack, bent and twists. (15Hrs) 117. Carryout Overhauling and Inspection of shackle, leaf spring, front & rear suspension. (15 Hrs) 118. Practice on removing, inspection and assembling of shock absorber (15 Hrs) 119. Practice Lubricating a suspension system. (10 Hrs) 120. Perform Trouble shooting for Suspension system defects: Wheel hop, ride height (unequal and low), noises under operation, fluid leakage, excessive travel, bounce, worn dampers, worn joints/ damaged linkages, vehicle “crabbing”. (20 Hrs)	Suspension Systems:- Principles of suspension, Suspension force, Unsprung weight, Wheel unit location, Dampening. Types of suspension-Suspension systems, Solid axle, Dead axle, Description, function and advantages of non indepen dentsuspension Independent suspen sion, Rear independent suspension, Rear-wheel drive independent suspension, electronically controlled air suspension (ECAS), Adaptive air suspension operation. Types of springs - Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs. Shock absorber types- Description and function of Hydraulic shock absorbers, Gas-pressurized shock absorbers, Load-adjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load-adjustable shock absorbers Front suspension types & components- Mc person Strut suspension, Short/long arm suspension, Torsion bar suspension Rear suspension, types & components Rigid axle leaf spring suspension, Rigid axle coilspring suspension, independent type suspension, Rigid non - drive suspension.

68- 69	- do -	121. Practice on removing wheels from light &Heavy vehicle, dismantling tyres and tubes checking puncture. (10 Hrs) 122. Practice Assembling & inflating tyres to correct pressure. (10 Hrs) 123. Check & adjust tire pressure by use of air or by Nitrogen(10 Hrs) 124. Rotate the wheels in vehicle minor repairs to wheels and tyres, wheel balancing & alignment. (10 Hrs) 125. Check for tyre wear patterns. (10 Hrs)	Wheels & Tyres-Wheel types & sizes Wheels, Rim sizes & designations, Types of wheels Tyre types&characteristics-Tyres,Radial ply tyres, Radial ply tyre sidewalls, Tyre pressure monitoring systems, Run flat tyres, Space-saver tyres, Tyre distortion, Center of gravity.Tyre construction-Tyre construction, Types of tyre construction, Tyre materials, Hysteresis, Tyre sizes & designations, Tyre ratings for temperature & traction. Descriptions Tirewear patterns and causes Nitrogenvs atmospheric air in tyres
70 - 73	- do -	126. Practice on Adjusting brake pedal play, Overhauling and inspection of tandem master cylinder assembly. (5 Hrs) 127. Perform Overhauling and inspection of front and rear brake assembly, overhauling and inspection of wheel cylinder assembly. (5 Hrs) 128. Bleed hydraulic brakes & Disk brakes. (10 Hrs) 129. Carryout Overhauling and inspection of vacuum assisted brake assembly. (10 Hrs) 130. Perform Overhauling and inspection of disc brake. (10 Hrs) 131. Practice 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. (15 Hrs) 132. Perform Brakes service procedures-Checking & adjusting brake fluid, Replacing brake fluid, Checking brake pads, Replacing brake pads, Removing & replacing a rotor, Replacing brake linings, Adjusting a parking brake cable.(15 Hrs) 133. Carryout 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. (15 Hrs) 134. Practice of maintaining of ABS system. (15 Hrs)	Braking Systems :- Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake pad,Regenerative braking. Braking systems - Brake type - principles, Air brakes, Exhaust brakes, Electric brakes, Parking brakes, Engine brakes, Regenerative braking Braking system components-Park brake system, Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder, Divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, Electro hydraulic braking (EHB), Applying brakes, Brake force, Brake light switch Drum brakes & components -Drum brake system, Drum brake operation, Brake linings & shoes, Back plate, Wheel cylinders Disc brakes & components -Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake callipers, Proportioning valves, Proportioning valve operation, Brake friction materials Antilock braking system & components-ABS brake system, Antilock braking system operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit.The construction and operation of heavy vehicle Anti-Slip Regulation / Traction Control (ASR) system.Introduction to Electromagnetic retarder brake (EMR) and Engine exhaust brake.
74 - 75	**Project Work/ Industrial Visit: -** **Broad Area:** a) Manual / Automatic Transmission b) Suspension system c) Steering system d) Wheels & tyres/ Braking system		
76 -78	**Revision**		

79 - 80	Troubleshoot vehicle Engine components and ascertain repair	135. Perform Trouble shooting Practice with Heavy vehicle for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. (50 Hrs)	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
81 - 84	Testing of electronic control system and check functionally.	136. Carryout Identification of Electronic control Unit. (20 Hrs) 137. Perform Set up for testing, Testing of Electronic Control Circuit. (20 Hrs) 138. Perform Identification of various sensors installed in engine & it's mounting. (20 Hrs) 139. Check instruments & Gauges on dash board & replace defective gauges. (20 Hrs) 140. Test Temperature sensor, Pressure senor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor. (20 Hrs)	Introduction to EFI Engine Management - EFI operation Modes of EFI, Electronic fuel injection, Idle speed control systems, Feedback & looping, Cold start systems, Air measurement, Air-flow monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram Electronic control unit(ECU) -EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp.Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes.EFI sensors- Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor.
85 -86	Diagnose & rectify the defects in vehicle to ensure functionality of vehicle.	141. Carryout Diagnosis- Possible causes and remedy for Engine cranks, but will not or hard to start, Poor fuel economy or engine performance. (25 Hrs) 142. Practice Checking ignition timing, Checking & changing a spark plug, Identification and testing of Hall Effect sensor, Optical sensor. Tracing and testing of sensor circuits. (25Hrs)	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 sensorsDistributor less ignition systems, Insulated coils, Distributor less ignition system timing.
87- 88	Carryout overhauling of charging system.	143. Check charging system for the cause of undercharge, No charge, and over charge conditions. (10 Hrs) 144. Perform Removing & replacing an alternator, Inspection of rotor for ground, open circuit – field coil resistance, slip ring surface, Fan, bearing. Inspection of stator for ground, open circuit, Inspection of Drive end bearing rotation, Rectifier, brush length compare with service manual. Slip ring surface. (10 Hrs)	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.

		145. Practice Inspecting & adjusting an engine drive belt, Replacing an engine drive belt / pulleys / Tensioner and their alignments. (10 Hrs) 146. Carryout Trouble shooting, possible causes and remedy for warning lamp does not glow when ignition switch is on, Warning lamp glows dim when ignition switch is on, warning lamp 'on' while the alternator is running, Warning lamp glows 'dim' while the alternator is running, warning lamp flickers considerably. (20 Hrs)	
89 - 90	Carryout overhauling of starting system.	147. Remove starter motor from vehicle, and carryout Performance test for pull-in test, Hold-in test, pinion (plunger) return test, No-load performance test. (15 Hrs) 148. Check Solenoid and test for Hold in coil open circuit, Armature test – Ground test, Open circuit test, pull-in coil open circuit test, field coil test. Inspect brush length wear as per service manual. (15 Hrs) 149. Perform 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. (15 Hrs) 150. Check a starting system, Jump-start a vehicle. (5 Hrs)	Starting system- purpose of starting system, Staring system components, Starter motor principles, study of starter control circuits. Startermotor construction, Starter magnet types, Starter motor engagement, Commutation, Switching, solenoid construction.
91 - 92	Troubleshoot electrical components of vehicle and ascertain repair	151. 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. (4 Hrs) 152. Perform Trouble shooting and remedy for Headlight - headlight do not light up, only one headlight does not light up, Only one beam ("Hi" or "Lo") does not light. (4 Hrs) 153. Perform Trouble shooting and remedy for turn signal and hazard warning lights - Flash rate high or one side only flashes, No Flashing, flash rate low. (4 Hrs) 154. Perform Trouble shooting and remedy for clearance, tail and license plate lights - All lights do not light up, some lights do not light up. (4 Hrs) 155. Perform Trouble shooting and remedy for Back-up light - Back-up lights do not light up. (4 Hrs) 156. Perform Trouble shooting and remedy for Brake lights -Brake lights do not light up, Brake light stay on. (4 Hrs) 157. Perform Trouble shooting and remedy for fuel meter and fuel gauge unit - Fuel meter shows no operation or incorrect operation. (4 Hrs)	Lighting system, Lamps/light bulbs, Lamp/light bulb information, LED lighting, Headlights-description of standard sealed beam, halogen sealed beam, composite and High intensity discharge (HID) headlights. Headlight & dimmer circuits, Park & tail light circuits, Brake light circuits, turn signal circuit, Cornering lights, Fog lights circuit, interior lights- courtesy, reading and instrument panel lights, Smart lighting ,Reverse lights

		158. Perform Trouble shooting and remedy for Engine coolant Temp (ECT) meter and ECT Sensor – Engine coolant temp meter shows no operation or incorrect operation. (4 Hrs) 159. Perform Trouble shooting and remedy for oil pressure light – Oil pressure warning light does not light up when ignition switch is on at engine off. (4 Hrs) 160. Perform Trouble shooting and remedy for brake and parking brake warning light- Brake warning light does not light up when fluid flow level, Brake warning light does not light up when parking brake pull up, Brake warning lights stay on. (4 Hrs) 161. Perform Trouble shooting and remedy for interior light- Interior light do not light up. (5 Hrs) 162. Perform Trace the wiring circuit of traffic signal flashers light circuit-tracing defects in the flasher circuits, replacing fuse bulb. (5 Hrs)	
93 - 94	Overhaul, service and testing Vehicle Air Conditioning system, its parts and check functionality.	163. Identify Air conditioning components, Performance test on A/c unit, (5 Hrs) 164. Check Charged state of refrigerant, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt. (10 Hrs) 165. Check heating system, Compressor rotation test, air Gap check, (5 Hrs) 166. Perform 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, (20 Hrs) 167. Check abnormal noise from compressor, Magnetic clutch, condenser, evaporator, Blower motor. (5 Hrs) 168. Carryout Diagnosis test for High pressure gauge –pressure high and low, Low pressure gauge for pressure high and low. (5 Hrs)	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, Temperaturemonitoring 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.
95 - 96	Troubleshoot electrical components of vehicle and ascertain repair	169. Perform Trouble shooting and remedy for Horn- No horn operation, poor sound quality, horn sounds continuously and to replace the horn if faulty. (5 Hrs) 170. Remove and install wiper motors and wiper switches. Checking & replacing wiper blades. (5 Hrs) 171. Perform Trouble shooting and remedy for windshield wiper and washer - no operation, intermittent operation, continuous operation, and wipers will not park. (5 Hrs)	Accessories: Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door lock circuit, remote keyless entry system circuit, antitheft system, immobilizer system. Navigation system, Car radio and cassette player, car videos.Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash

		172. Diagnose causes for improper operation of the windshield washer system and to replace the pump if faulty. (6 Hrs) 173. Diagnose the power window system for – all power window motors do not operate, some switches do not operate. (6 Hrs) 174. Diagnose the power door lock control for – All power door locks do not operate, only one power door lock not operate. (6 Hrs) 175. Diagnose for remote keyless entry and immobilizer system. (6 Hrs) 176. Familiarization of car radio wiring and speaker circuits. (5 Hrs) 177. Diagnose automatic seat belt systems, Diagnose air bag system and service warnings. (6 Hrs)	sensors, Seat belt pre-tensioners, Tire pressure monitoring systems Integrated communications, Proximity sensors, Reflective displays, Global positioning satellites, Triangulation/ trilateration,Telematics. Networking & multiplexing. Introduction to Hybrid & Electronic vehicle, Hydrogen fuel cell vehicle, Electrical & Electronic architecture.
97 - 99	Drive vehicle following Traffic Regulations and maintenance of good road conduct.	Driving Practice. 178. Practice in straight driving on wide roads. (15 Hrs) 179. Driving through lanes and curves. (15 Hrs) 180. Practice in reversing. (15 Hrs) 181. Practice overtaking another vehicle. (15 Hrs) 182. Practice in driving through sand and wet surfaces. Practice in parking and Diagonal parking. (15 Hrs)	Locating vehicle information, Obtaining & interpreting scan tool data, Using a repair manual, Using a shop manual, Using an owner's manual, Using a labour guide, Using a parts program, Using a service information program
100 -101	**Project Work/ Industrial Visit: -** **Broad Area:** a) MPFI and CRDI b) Engine scanning c) Starting system d) Lighting system e) HVAC f) Electrical accessories		
102- 103	**Revision**		
104	**Examination**		