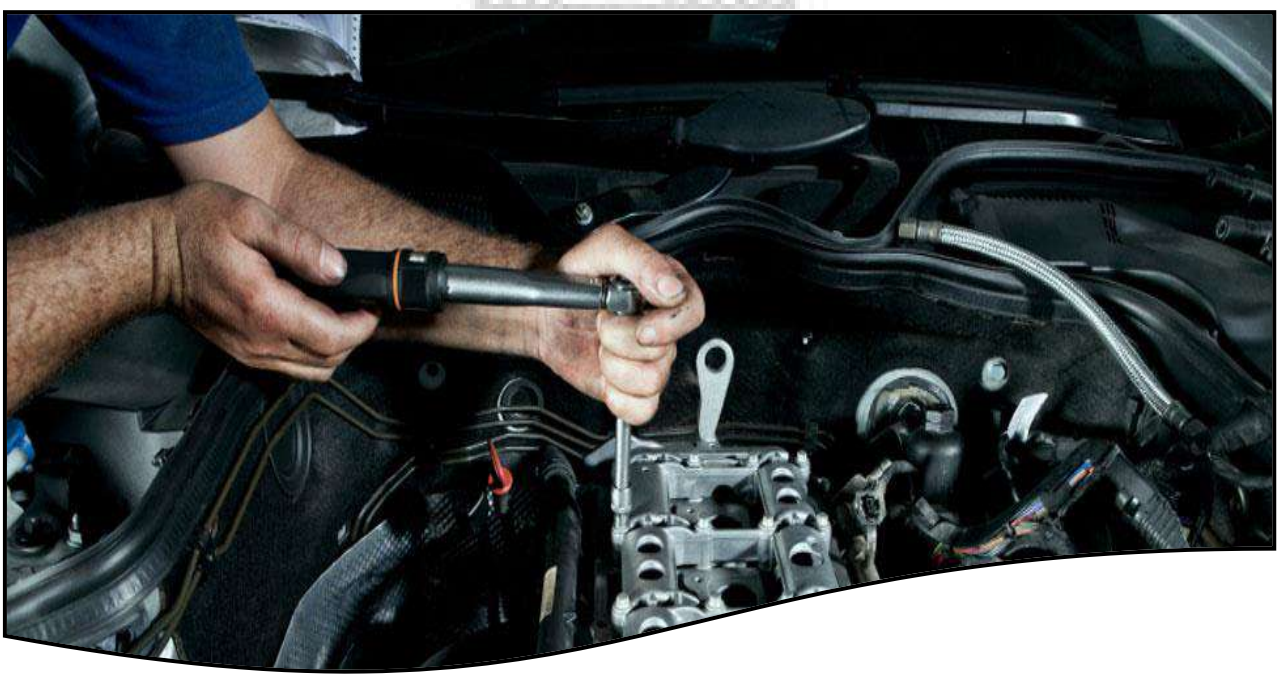
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

Advanced Diploma (Vocational) in AUTOMOTIVE TECHNOLOGY



Sector - Automotive

Advanced Diploma (Vocational) in Automotive Technology

(Designed in 2019)

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NSQF LEVEL – 6

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Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091
www.cstaricalcutta.gov.in

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S No.	Name & Designation Sh/Mr./Ms.	Organization	Remarks
Industry/Academic Representative:			
1.	P. Thangapazham, AGM	HR Training, Daimler, Chennai	Member
2.	S. Venkatakrishnan, Dy.Mgr (VSITP)	Maruti Suzuki India Ltd, Chennai	Member
3.	Murugesan.P., DGM – Training	TVS Training & Services Ltd, Chennai	Member
4.	M.Arulmozhivarman, Technical Manager	LansonToyaota, Chennai	Member
5.	V. Krishanshankar, DGM	Training Ashok Leyland, Chennai	Member
6.	Atul Chandekar, Divisional Manager, Service Training	Ashok Leyland, Chennai	Member
7.	R. Jayaprasad, Automobile Instructor	GTTI-Coimbatore	Member
8.	Dr. R. Subramanian, Prof and Head	Department of Automobile Engineering, IRTT,Erode.	Member
9.	M.Veerasamy, GM, Service	CARS India Ltd	Member
10.	N.Arunkumar, Asst. Manager	Ashok Leyland, Chennai	Member
11.	R.Durai Raj, Asst. Manager DCTC	LansonToyaota, Chennai	Member
12.	Ramaiah, Senior Manager, Retd.	Airport Authority of India, Chennai	Member
13.	D.Viswanathan, Senior Manager	LansonToyaota, Chennai	Member
14.	Shri Dr.K.Annamali, HOD,	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member

DGT/MSDE Representative			
1.	Dinesh Kumar Nijhawan, Director	CFI, DGT/MSDE, New Delhi	Chairman
2.	R. Senthilkumar, Director	ATI Chennai	Member
3.	M.K.Parial, Joint Director of	DGT/MSDE, New Delhi	Member

	Trg		
4.	Sandeep Kosaraju, Young Professional	DGT/MSDE, New Delhi	Member
5.	Madhu Nair, Executive Director I/C	NIMI, Chennai	Member
6.	C.Chandrasekar, Principal/Joint Director of Training	CTI, Chennai	Member
7.	K.Srininvasa Rao, Joint Director of Trg,	NIMI, Chennai	Member
8.	S.Mathivanan, Joint Director of Training	ATI Chennai	Member
9.	Dr.M.Jayaprakasan, Deputy Director of Training	ATI Chennai	Member
10.	B.Ravi, Deputy Director of Training	ATI Chennai	Member
11.	C.Yuvaraj, Deputy Director of Training	Section I/C Automotive, ATI Chennai	Member
12.	R.RajeshKanna, Training Officer- Automotive	ATI Chennai	Member
13.	Ramesh Kumar, Training Officer	CTI Chennai	Member

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1. COURSE INFORMATION

Introduction:

The Ministry of Skill Development and Entrepreneurship is an apex organization for the development and coordination of the vocational training in our country. The Ministry conducts the vocational training programmes through the Craftsmen Training Scheme (CTS), Apprenticeship Training Scheme (ATS), under the Skill Development Initiative (SDI) Scheme, and Craftsmen Instructor Training Scheme (CITS) to cater the needs of different segments of the Labour market. The Directorate General of Training (DGT) acts as a central agency to advise Government of India in framing the training policy and coordinating vocational training throughout India. The day-to-day administration of the ITIs rests with the State Governments/ Union Territories.

Skill Diploma Initiative:

In addition to that, the Ministry has planned to start Skill Diploma courses to cater the need of demand raised on a comprehensive workforce requirement, under DGT gamut. The proposed skill diploma holders will be trained more on practical competencies (70% Practical & 30% Theory) rather than more of theoretical knowledge offered in polytechnic/Diploma colleges.

Benefits:

Industry Advantage:

The Ministry of skill Development & Entrepreneurship will provide a pool of automotive engineering technician personnel at shop floor supervisor cum worker level, trained to international bench mark for industry. This will also enable industry to take challenges in the Fabrication product development and manufacturing.

Career for Automotive Engineering Professionals:

The Advanced Diploma (Vocational) offers opportunity for upward career progression for the DGT-NTC certificate holders. There is enormous scope to obtain national and overseas appointment for Advanced Diploma (Vocational) holders starting from the ground level to Automobile engineer.

Course Particulars:

In this Advanced Diploma (Vocational) in Automotive Technology, the trainee is trained on **Five Core modules** each of 320 hours duration in first year. Each Core module contains professional skill & professional knowledge. In addition to this, the trainee is entrusted with the project work and extracurricular activities to build up confidence. In second year, there are three electives where trainee has to select any of two elective modules, each module containing 320 hours duration with total duration of 640 hours. The trainee will be trained in Industry for 800 hours (as a part of on-the-job training). There will be a common subject for all Advanced Diploma (Vocational) courses on **Employability Skills** which will be for 160 hours in second year. The module wise course coverage is categorized as below: -

Core Module 1 (Automotive Engineering - Basics): This subject will focus on trainees toreview the concept of workshop safety, Engineering Drawing, Engineering measurements, Fits and tolerances, strength of material, fluid power engineering, Theoretical Engine cycle, Manufacturing concepts and Industrial Engg, Basics of Electrical and Electronics, Vehicle Nomenclature and customer relationship, this will prepare trainees to apply the basics in servicing of vehicles

Core Module 2 (Automotive Electrical and Electronic System - Diagnosis & Repair): This course will prepare the trainees to enhancement skill level in fast pace of technological change impact in Auto Electrical and Electronic system, the development of hybrid and alternative –fuel cars is just one example, the use of isolation meters and scan tools, leads the trainees in diagnostic skills through troubleshooting and service of ignition, Starter motor, Alternator and battery,soelectronics is a vital part of the training for automotive technicians. Telematics, which is an increasingly important automotive technology, is covered in considerable detail (including the theory of GPS navigation systems).

Core Module 3 (Automotive Engines-Diagnosis & Repair (MPFI & CRDI)): On completion of this module, trainees should be able to equip with diagnostic & repair skills in automotive engines. It details the construction, operation, diagnosis, service, and repair of engine (MPFI and CRDI), diagnosis on four-valve-per-cylinder engines, camshaft timing, variable valve timing, and high-performance engines, including, Superchargers, Turbochargers, hybrid engines and high-performance component**s,** finally this course prepares trainees to service today's vehicles.

Core Module 4 (Automotive Transmission Diagnosis & Repair): Automotive axle and transmission subject will prepare the trainees with diagnostic & repair skills in Power train module of automatic transmissions, manual transmissions, clutch, drive line and drive axle construction and operation including dual clutch systems, various limited-slip differential designs, six-speed transmissions, continuously variable transmissions (CVT), drivelines for front-wheel drive (FWD) and four-wheel drive (4WD) vehicles

Core Module 5 (Automotive Vehicle Controls- Brake, Suspension and Steering Diagnosis & Repair): This Module will make the trainees conversant with concept, techniques and practices in automotive vehicle dynamics and safety. The course will cover the brake system controls. Performing hands-on service and repair tasks, diagnosis and service suspension and steering systems on today's cars, including: run-flat tires, shock absorber mountings, electronic power and four-wheel steering systems, and new wheel alignment procedures.

Elective Module 1 (Automotive Air Conditioning and Climate Control System: Diagnosis and Repair): This subject will prepare the trainees in practical and legislative aspects of vehicle climate control systems. Provide professional skill of current A/C systems, refrigerants and the new possible replacement systems like CO2, and includes unrivalled coverage of electronic and electrical control.

Elective Module 2 (Auto body Repair and Refinishing): Auto body repair and refinishing, is an exciting skill area to apply with millions of vehicles on the road today, there is a strong demand for well-trained collision repair technicians. With today's high-tech vehicles and varied construction methods and repair techniques, competent collision repair takes well-trained, knowledgeable professionals. This course will prepare the trainees repairing a collision-damaged vehicle and estimation, major body/frame repairs, vehicle frame damage measurement and repair, details refinishing and how to prep and paint the vehicle.

Elective Module 3 (Automotive Two-Wheeler – Diagnosis and repair): This subject will prepare a trainee to take carrier in two-wheeler manufacturing company "fit to work" in the assembly line directly. By the end of the program the trainee s equipped with hands on practical skills, basic theoretical knowledge. This course will develop trainee's capability of performing sequential jobs independently. The content of the subject covers today basic two-wheeler technology to advanced one as ECM and sensor system

Project work /Working Model (Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration), Work to be assigned in a group (Group of at least 4 trainees) from the starting of the Advanced Diploma (Vocational)programme. The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit **Project report.**

On the Job Training: In this module the trainees will be working/training in the Industry for 800 hours. They work as apprentices/Personnel.

Employability Skills: This module is common for all Advanced Diploma (Vocational) courses and the total period is 160 hours. In this module the trainees will improve

- English literacy such as Pronunciation, functional grammar, reading, writing, speaking and spoken English

- Learn communication skills, listening skills, motivational training, Facing interviews and behavioural skills.
- Understand concepts of Entrepreneurship, Project preparation and marketing analysis, Institutions support and Investment Procurement.
- Understand on productivity, its benefits, affecting factors, comparison with developed countries, personal finance management.
- Understand Safety, Health and Environment Education - Safety & Health, Occupational Hazards, Accident & safety, First Aid, Basic Provisions, Ecosystem, Pollution, Energy Conservation, Global warming, Ground Water, Environment.
- Understand benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment of Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
- Understand Quality Tools: Quality Consciousness, Quality Circles, Quality Management System, Housekeeping.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of Vocational Training courses catering to the need of different sectors of economy/ Labour market. The Vocational Training Programmes are delivered under aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of DGT for propagating vocational training. Recently DGT has started Advanced Diploma (Vocational)s for different streams and primarily implemented at DGT field institutes such as NSTIs, FTIs and AHI and planned to expand to State Directorates in future.

Automotive Technology course is very much essential in the current scenario due to a lot of demand in Automotive Sector. The course is for two years duration. In the first year there are five core modules each module is credit base and employable. Each module is of 320 hours and is very much independent. In second year, the trainee will be taking two elective modules out of three electives each of 320 hours and will be doing on the job training in Industry for 800 hours. In addition, the trainees will pick up employability skills for 160 hours. After passing out the training programme, the trainee will be awarded Advanced Diploma (Vocational) by DGT which has worldwide recognition.

Candidates need broadly to demonstrate that they are able to:

- Read and interpret technical parameters/ documents, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge & employability skills while performing jobs.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS

- Can pursue higher technical education like BE/B. Tech.

- On successful completion of this course, the candidates shall be gainfully employed in the following industries:
    - Automobile and allied industries
    - In public sector industries and private industries in India & abroad.

- Can start their own enterprise on concerned trade.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of two years: -

S No.	Module	Course Element	Notional Training Hours
1	**For five Core Modules**	Professional Skill (Trade Practical)	1000
		Professional Knowledge (Trade Theory)	600
2	**For two Elective Module**	Professional Skill (Trade Practical)	400
		Professional Knowledge (Trade Theory)	240
3	**Employability Skills**		160
4	**On the job training**		800
	Total		**3200**

Core Components (3200 Hrs): -

Name		Teaching Hours		Total Hours
Core Subjects (All Compulsory)		**Practical**	**Theory**	
1	Automotive Engineering Basics	224	96	1600
2	Automotive Electrical & Electronic Systems - Diagnosis &Repair	224	96	
3	Automotive Engine - Diagnosis &Repair	224	96	
4	Automotive Transmission Diagnosis &Repair	224	96	
5	Automotive Controls - Brake, Suspension and Steering Diagnosis &Repair	224	96	
Elective Subjects (any two)				
6	Automotive Air Conditioning and Climate Control System Diagnosis and Repair	224	96	640
7	Automotive Body repair & Refinishing	224	96	
8	Automotive Two &Three-Wheeler – Diagnosis and repair	224	96	

Industrial Training			
9	On the Job Training	800	800
Common Subjects			
10	Employability Skills	160	160
Total Hours of Training			3200

Note : 1. The trainee must complete all the 5 core modules
2. The trainee must select any of two elective courses from the given three elective options

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course at each module and at the end of the training programme as notified by Govt of India from time to time.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of **summative assessment** method. The All India Trade Test for awarding Advanced Diploma (Vocational) will be conducted by DGT as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking

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

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Weightage in the range of above 75% - 90% to be allotted during assessment	

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.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weightage in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Automotive Engineering Technician sets up and operates equipment to test automobile parts and accessories according to standard procedures to discover design and fabrication faults. Studies drawings, sketches, specifications set, and installs units such as assemblies, gears, universal joints in testing equipment and machines and connects wiring, tubing, couplings and power sources using hand tools. Operates test equipment and machines to determine factors such as stress, strain, pressure, flow of fuel, oil and air, wear and usability of installed units under conditions of heat, cold, high speeds and load. Conducts investigations into experimental tests in development of new automotive equipment and accessories to secure more economical operating basis and lowering manufacturing cost. Supervises assembly and repair work, effects necessary modifications and replacements of parts and checks completed assembly for efficiency of performances. Studies in detail costs involved and seeks lighter and stronger metal parts in auto. May specialize in testing or repairs of particular type of auto equipment and accessories.

ReferenceNCO-2015:

i) 3115.0201 – Automotive Engineering Technician/ Testing Manager

4. GENERAL INFORMATION

Name of the Course	**Advanced Diploma (Vocational) in Automotive Technology**
NCO – 2015	3115.0201
NSQF Level	Level 6
Duration	2 Years (3200 Hours)
Entry Qualification	**NTC/NAC**(Mechanic Motor Vehicle, Mechanic Diesel, Mechanic Tractor, Mechanic Motor Cycle, Mechanic Auto Electrical & Electronics, Mechanic Auto Body Repair, Mechanic Auto Body Painting)
Minimum Age	17 years as on first day of academic session.
Unit Strength	20
Space Norms	800 sq. m.
Power Norms	40 KW
Instructor's Qualification for	
Automotive Technology	B.Voc/ Degree in Automobile/ Mechanical Engineering from AICTE/ UGC recognized Engineering College/ university with two years industrial experience in the relevant field. OR Diploma in Automobile/ Mechanical Engineering or relevant Advanced Diploma (Vocational) from DGT with five years experience in the relevant field. OR NTC/NAC passed in the Trade of "Mechanic Motor Vehicle or other similar trade" with seven years experience in the relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in related trade, in any of the variants under DGT.
(iv) Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills from DGT institutes. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) OR Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills from DGT institutes.
Minimum Age for Instructor	21 Years

5. NSQF LEVEL COMPLIANCE

NSQF level for Advanced Diploma (Vocational) in Automotive Technology: Level 6

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
e. Responsibility

The Broad Learning outcome of **Advanced Diploma (Vocational) in Automotive Technology** mostly matches with the Level descriptor at Level- 6.

The NSQF level-6 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 6	Demands wide range of specialized technical skill, clarity of knowledge and practice in broad range of activity involving standard nonstandard practices.	Factual and theoretical knowledge in broad contexts within a field of work or study.	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.	Reasonably good in mathematical calculation, understanding of social, political and reasonably good in data collecting organizing information and logical communication.	Responsibility for own work and learning and full responsibility for other`s works and learning.

6. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

6.1 LEARNING OUTCOMES (TRADE SPECIFIC)

1. Identify and choose safe working practices, environment regulations and housekeeping.
2. Select and make use of various precision measuring instruments, determine the dimension of components and record the data.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work.
4. Organize and carry out various metal testing methods, determine the values and compare with the standards.
5. Identify and explain the hydraulic and pneumatic components in the workshop and vehicles.
6. Organize and measure various engine parameters (torque, BHP, BMEP, IHP etc.).
7. Organize and carry out joining of metals using different methods and test for defects.
8. Check and interpret vehicle specification data and VIN and prepare a job card.
9. Plan and perform various basic tests related with auto electrical and electronics and interpret the values obtained by comparing with the standards.
10. Plan and perform the trouble shooting, diagnosis of automotive electrical system, determine and solve the problems and justify the results.
11. Plan and perform the trouble shooting, diagnosis of automotive electronics and communication system, determine and solve the problems and justify the results.
12. Demonstrate troubleshoot and Diagnosis of vehicle safety system.
13. Plan and organize the trouble shooting, diagnosis of automotive electrical accessories, determine and solve the problems and justify the results.
14. Plan and organize the troubleshooting and diagnosis of intake and exhaust system.
15. Plan and organize the troubleshooting and diagnosis of power plant (Engine: Construction, Petrol and Diesel).
16. Plan and perform the trouble shooting, diagnosis of automotive electronics and communication system, determine and solve the problems and justify the results.
17. Plan and organize the troubleshooting and diagnosis of cooling and lubricating system.
18. Formulate and perform the troubleshooting and diagnosis of Electric and Electronic related to power plant MPFI and CRDI.
19. Plan and organize to find the faults and Diagnosis of manual Transmission system and suggest appropriate measure for manual transmission, transaxle, differential and final drive.

20. Examine/interpret the faults in Diagnosis of automatic Transmission system and suggest appropriate measure for automatic Gear boxes.

21. Plan and organize to find the faults and Diagnosis of vehicle controls (conventional) and suggest appropriate measure for brake, suspension and steering system.
22. Examine/interpret the faults in Diagnosis of vehicle control system (advanced) and suggest appropriate measure for antilock brake and power steering.
23. Evaluate driving performance of trainees.
24. Demonstrate Diagnosis of automotive air conditioning and climate control system.
25. Plan and organize the troubleshooting and diagnosis of automotive air conditioning and climate control system components.
26. Organize and analyse the misalignment of the body due to an accident, estimate the amount of repair to be carried out and propose for repairing of vehicle body.
27. Plan and organize to carry out the body alignment work and perform the welding processes to make the body perfect for riding.
28. Plan and organize to carry out the body painting work and perform the finishing work.
29. Plan and organize to carry out maintenance and overhauling of different types of engines in two and three wheelers, determine its functionality and its performance.
30. Plan and organize to carry out maintenance and overhauling of different types of transmission in two and three wheelers, determine its functionality and its performance.
31. Plan and organize to find the faults and Diagnosis of vehicle controls and suggest appropriate measure for brake, suspension and steering system.
32. Plan and organize to find the faults and Diagnosis of vehicle electrical and electronics and suggest appropriate measure for its functionality.

6.2 LEARNING OUTCOMES (EMPLOYABILITY SKILLS)

1. Exhibit leadership qualities and entrepreneurship skills.
2. Apply organisational principles and practices using creative abilities and digital skills.
3. Organize work efficiently by self-management and effective communication.
4. Implement Continuous Professional Development (CPD) using emotional intelligence.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

LEARNING OUTCOMES (TRADE SPECIFIC)		
MODULE 1: AUTOMOTIVE ENGINEERING BASICS		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Identify and choose safe working practices, environment regulations and housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
		1.2 Recognize and report all unsafe situations according to the 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 and observe site policies and procedures in regard to illness or accident.
		1.5 Identify personal protective equipment (PPE) and use the same as per related working environment.
		1.6 Identify basic first aid and use them under different circumstances.
		1.7 Identify different fire extinguisher and use the same as per requirement.
		1.8 Identify vehicles with safety equipment and follow safety rules to carry out work on them.
2	Select and make use of various precision measuring instruments, determine the dimension of components and record the data.	2.1 Select appropriate precision measuring instruments such as Vernier calliper, micrometre, dial bore gauge, dial test indicator etc.
		2.2 Ascertain the functionality and correctness of the instrument.
		2.3 Measure various dimension of the components and record data to analyse with the given drawing/measurement.
3	Interpret specifications, different engineering drawing and apply for different application in the field of work.	3.1 Read and interpret the information on drawing and apply in executing practical work.
		3.2 Read and analyse the specification to ascertain the material requirement, tools and machining/assembly/maintenance parameters.
		3.3 Draw the free hand sketch of work shop layout and various components of engine.

4	Organize and carry out various metal testing methods, determine the values and compare with the standards.	4.1	Explain the concept of basic science related to the field of strength of material.
		4.2	Plan and prepare as per procedure and safety methods of metal testing equipment.
		4.3	Carry out the testing of metals and record the values.
		4.4	Calculate and find out the results to determine the strength of materials.
5	Identify and explain the hydraulic and pneumatic components in the workshop and vehicles.	5.1	Explain the concepts of basic science related to the field of fluid power
		5.2	Trace out the hydraulic circuit in work shop equipment and vehicles
		5.3	Identify the components of pneumatic circuit in the vehicles
6	Organize and measure various engine parameters (torque, BHP, BMEP,IHP etc.)	6.1	Explain the basic calculation and science related with the speed and engine terminologies.
		6.2	Plan and prepare as per procedure and safety methods of engine testing equipment.
		6.3	Carry out the testing of engine and record the values.
		6.4	Calculate and find out the results to determine the performance of the engine.
		6.5	Draw the heat balance sheet determine the performance of the engine.
7	Organize and carry out joining of metals using different methods and test for defects.	7.1	Determine the principles, process of different welding process applicable in automobile industry.
		7.2	Select the appropriate machine to carry out the metal joining process.
		7.3	Select the type and size of the consumables to carry out the metal joining process.
		7.4	Set and process the metal joining as per the drawing.
		7.5	Clean the work piece and inspect it for and type of defect.
8	Checkand interpret vehicle specification data and VIN and prepare a job card.	8.1	Identify different types of vehicle.
		8.2	Identify the different vehicle specification data and information.
		8.3	Coordinate with the customer to know about the problems and prepare the job card.

9	Plan and perform various basic tests related with auto electrical and electronics and interpret the values obtained by comparing with the standards.	9.1	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
		9.2	Set the multimeter to carry out electrical measurement parameters.
		9.3	Perform electrical measurements with different parameters in various vehicle circuits and record the results.
		9.4	Perform voltage drop tests and suggest the condition of the electrical wiring.
		9.5	Carry out testing of various electronic components and suggest for its functionality.
		9.6	Identify the engine electronic problems by combination meter and suggest for remedies.

MODULE 2: AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEM – DIAGNOSIS&REPAIR		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Plan and perform the trouble shooting, diagnosis of automotive electrical system, determine and solve the problems and justify the results	1.1 Plan and execute dismantling & assembling of electrical system components.
		1.2 Inspect and test auto electrical System components and determine the correctness of each component.
		1.3 Check and propose possible optimization and compare their cost effectiveness.
		1.4 Contribute to continuous improvement of work process in the related area.
2	Plan and perform the trouble shooting, diagnosis of automotive electronics and communication system, determine and solve the problems and justify the results.	2.1 Plan and execute removing and refitting the automobile electronics and communication system components.
		2.2 Inspect the auto electronics and communication System components and determine the correctness of each component.
		2.3 Check and propose possible optimization and compare their cost effectiveness.
		2.4 Contribute to continuous improvement of work process in the related area.
3	Demonstrate troubleshoot and Diagnosis of vehicle safety system.	3.1 Identity causes of malfunctions and errors of vehicle safety system
		3.2 Evaluate the possibility of the rectification of such malfunction and errors
		3.3 Conduct appropriate and target oriented discussion within the team
		3.4 Carryout or arrange for repair
		3.5 Ensure or improve the functionality of the system by controlling and monitoring different parameters of various vehicle safety systems.
		3.6 Use protective and safety equipment.
4	Plan and organize the trouble shooting, diagnosis of automotive electrical accessories, determine and solve the problems and justify the results.	4.1 Plan and execute dismantling & assembling of automobile electrical accessories.
		4.2 Inspect and test the auto electrical accessories and determine the correctness of each component.
		4.3 Check and propose possible optimization and compare their cost effectiveness.
		4.4 Contribute to continuous improvement of work process in the related area.

MODULE 3: AUTOMOTIVE ENGINE – DIAGNOSIS AND REPAIR		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Plan and organize the troubleshooting and diagnosis of intake and exhaust system.	1.1 Plan and execute dismantling & assembling of intake and exhaust system components.
		1.2 Inspect the intake and exhaust system components and determine its proper functionality.
		1.3 Check and propose possible optimization and compare their cost effectiveness.
		1.4 Contribute to continuous improvement of work process in the related area.
2	Plan and organize the troubleshooting and diagnosis of power plant (Engine: Construction, Petrol, Diesel)	2.1 Plan and execute dismantling & assembling of Engine from vehicle along with other accessories.
		2.2 Test engine for its correctness and justify the results.
		2.3 Measure the engine components, compare the values with standards and determine its functionality
		2.4 Check and propose possible optimization and compare their cost effectiveness.
		2.5 Contribute to continuous improvement of work process in the related area.
		2.6 Test Engine Performance.
		2.7 Monitor Evaluated and document work result.
3	Plan and perform the trouble shooting, diagnosis of automotive emission control system, determine and solve the problems and justify the results.	3.1 Plan and execute removing and refitting the auxiliary emission control device components.
		3.2 Inspect the auxiliary emission control device components and determine the correctness of each component.
		3.3 Check and propose possible optimization and compare their cost effectiveness.
		3.4 Contribute to continuous improvement of work process in the related area.
		3.5 Monitor emission of vehicle and execute different operation to obtain optimum pollution as per emission norms.
4	Plan and organize the troubleshooting and	4.1 Plan and execute dismantling & assembling of cooling and lubrication system components.

	diagnosis of cooling and lubricating system.	4.2	Inspect and test the cooling and lubrication system components and determine its proper functionality.
		4.3	Check and propose possible optimization and compare their cost effectiveness.
		4.4	Contribute to continuous improvement of work process in the related area.
5	Formulate and perform the troubleshooting and diagnosis of Electric and Electronic related to power plant MPFI and CRDI	5.1	Plan and execute dismantling & assembling of MPFI and CRDI system components.
		5.2	Rectify the defects following the vehicle manufacture standard procedure
		5.3	Select and use testing methods that comply with the manufacturer's requirements
		5.4	Check and propose possible optimization and compare their cost effectiveness
		5.5	Test Performance of serviced units for functionality.

MODULE 4: AUTOMOTIVE TRANSMISSION – DIAGNOSIS AND REPAIR		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Plan and organize to find the faults and Diagnosis of manual Transmission system and suggest appropriate measure for manual transmission, transaxle, differential and final drive.	1.1 Plan and carry out dismantling and assembling of vehicle Transmission system units, adhering to the specifications and tolerances for the vehicle and following: a. The manufacturer's approved overhauling methods b. Standard/ non-standard repair methods c. health and safety requirements. d. workplace procedures.
		1.2 Check the proper functional sequence.
		1.3 Check and propose possible optimization and compare their cost effectiveness.
		1.4 Contribute to continuous improvement of work process in the related area.
		1.5 Monitor evaluates and document work result.
2	Examine/interpret the faults in Diagnosis of automatic Transmission system and suggest appropriate measure for automatic Gear boxes.	2.1 Plan and execute overhauling of vehicle automatic Transmission system units, adhering to the specifications and tolerances for the vehicle and following: A. The manufacturer's approved overhauling methods B. Standard/ nonstandard repair methods C. health and safety requirements. D. workplace procedures.
		2.2 Assemble sub-assemblies and components in a manner appropriate to the location and their functionality.
		2.3 Check the proper functional sequence.
		2.4 Check and propose possible optimization and compare their cost effectiveness.
		2.5 Contribute to continuous improvement of work process in the related area.
		2.6 Monitor evaluates and document work result.

MODULE 5: AUTOMOTIVE CONTROLS BRAKE, SUSPENSION AND STEERING DIAGNOSIS AND REPAIR		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Plan and organize to find the faults and Diagnosis of vehicle controls (conventional) and suggest appropriate measure for brake, suspension and steering system.	1.1 Plan and carry out dismantling and assembling of vehicle control system units (conventional), adhering to the specifications and tolerances for the vehicle and following: a. The manufacturer's approved overhauling methods b. Standard/ non-standard repair methods c. health and safety requirements. d. workplace procedures.
		1.2 Check the proper functional sequence.
		1.3 Check and propose possible optimization and compare their cost effectiveness.
		1.4 Contribute to continuous improvement of work process in the related area.
		1.5 Monitor evaluates and document work result.
2	Examine/interpret the faults in Diagnosis of vehicle control system (advanced) and suggest appropriate measure for antilock brake and power steering.	2.1 Plan and execute overhauling of vehicle control system units (advanced), adhering to the specifications and tolerances for the vehicle and following: A. The manufacturer's approved overhauling methods B. Standard/ non-standard repair methods C. health and safety requirements. D. workplace procedures.
		2.2 Assemble sub-assemblies and components in a manner appropriate to the location and their functionality.
		2.3 Check the proper functional sequence.
		2.4 Check and propose possible optimization and compare their cost effectiveness.
		2.5 Contribute to continuous improvement of work process in the related area.
		2.6 Monitor evaluates and document work result.
3	Evaluate driving performance of trainees.	3.1 Practice Initial freeway Driving & assess the same.
		3.2 Check Pre – Driving parameters
		3.3 Practice Driving on Various road as per rule & evaluate the same.

Elective 1: AUTOMOTIVE AIR CONDITIONING AND CLIMATE CONTROL SYSTEM- DIAGNOSIS AND REPAIR		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Demonstrate Diagnosis of automotive air conditioning and climate control system.	1.1 Identity causes of malfunctions and errors of vehicle air conditioning system.
		1.2 Evaluate the possibility of the rectification of such malfunction and errors of vehicle Air conditioning system.
		1.3 Conduct appropriate and target oriented discussion within the team.
		1.4 Carryout or arrange for repair.
		1.5 Ensure or improve the functionality of the system by controlling and monitoring different parameters of vehicle Air conditioning system.
		1.6 Use protective and safety equipment.
2	Plan and organize the troubleshooting and diagnosis of automotive air conditioning and climate control system components.	2.1 Plan and execute dismantling & assembling of air conditioning and climate control system components.
		2.2 Inspect and test the air conditioning and climate control system components and determine its proper functionality.
		2.3 Check and propose possible optimization and compare their cost effectiveness.
		2.4 Contribute to continuous improvement of work process in the related area.

Elective 2: AUTOMOTIVE BODY REPAIR AND REFINISHING		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Organize and analyze the misalignment of the body due to an accident, estimate the amount of repair to be carried out and propose for repairing of vehicle body.	1.1 Plan and execute to find out the damages of the vehicle and prepare document to record the reports.
		1.2 Estimate the amount of expenditure to repair the body damages.
		1.3 Carry out the repair work and assess the work for its proper finishing
2	Plan and organize to carry out the body alignment work and perform the welding processes to make the body perfect for riding.	2.1 Plan and execute body alignment work and welding processes.
		2.2 Inspect the vehicle body to determine its proper correctness.
		2.3 Check and propose possible optimization and compare their cost effectiveness.
		2.4 Contribute to continuous improvement of work process in the related area.
3	Plan and organize to carry out the body painting work and perform the finishing work.	3.1 Plan and execute body painting work and finishing processes.
		3.2 Inspect the vehicle body to determine its proper perfectness.
		3.3 Check and propose possible optimization and compare their cost effectiveness.
		3.4 Contribute to continuous improvement of work process in the related area.

Elective 3: AUTOMOTIVE TWO &THREE WHEELER- DIAGNOSIS AND REPAIR		
S No.	**Learning Outcomes**	**Assessment Criteria**
1	Plan and organize to carry out maintenance and overhauling of different types of engines in two and three wheelers, determine its functionality and its performance.	1.1 Plan and execute dismantling and assembling of engine components and evaluate the condition of the components.
		1.2 Determine the functionality of engine components by measuring the components and compare with the standards.
		1.3 Check and propose possible optimization and compare their cost effectiveness.
		1.4 Contribute to continuous improvement of work process in the related area.
		1.5 Monitor evaluates and document work result.
2	Plan and organize to carry out maintenance and overhauling of different types of transmission in two and three wheelers, determine its functionality and its performance	2.1 Plan and execute dismantling and assembling of transmission components and evaluate the condition of the components.
		2.2 Determine the functionality of components by measuring the transmission components and compare with the standards.
		2.3 Check and propose possible optimization and compare their cost effectiveness.
		2.4 Contribute to continuous improvement of work process in the related area.
		2.5 Monitor evaluates and document work result.
3	Plan and organize to find the faults and Diagnosis of vehicle controls and suggest appropriate measure for brake, suspension and steering system.	3.1 Plan and carry out dismantling and assembling of vehicle control system units (conventional), adhering to the specifications and tolerances for the vehicle.
		3.2 Check the proper functional sequence.
		3.3 Check and propose possible optimization and compare their cost effectiveness.
		3.4 Contribute to continuous improvement of work process in the related area.
		3.5 Monitor evaluates and document work result.
4	Plan and organize to find the faults and Diagnosis of vehicle electrical and electronics and suggest appropriate measure for its functionality.	4.1 Plan and carry out removing, refitting and servicing of vehicle electrical and electronics system components, test and compare with the standards to decide its correctness.
		4.2 Check the proper functional sequence.
		4.3 Check and propose possible optimization and compare their cost effectiveness.
		4.4 Contribute to continuous improvement of work process in the related area.
		4.5 Monitor evaluates and document work result.

LEARNING OUTCOME (EMPLOYBILITY SKILLS)	
Learning Outcomes	**Assessment criteria**
1 Exhibit leadership qualities and entrepreneurship skills.	1.1 Interact with varied individuals and convince them by resolving differences.
	1.2 Assess risk with risk analysis tools and take initiatives.
	1.3 Contemplate differently with an innovative mindset.
	1.4 Persevere under pressure with stress management.
	1.5 Develop healthy relationship with client.
	1.6 Choose opportunities, for entrepreneurship development, not obvious to others.
	1.7 Assess the competitive advantage of ideas.
	1.8 Identify customer or client requirements.
	1.9 Determine the commercial viability of ideas.
	1.10 Demonstrate sensitivities (political, commercial, environmental, cultural, and so on).
	1.11 Identify opportunities for setting up business.
2 Apply organisational principles and practices using creative abilities and digital skills.	2.1 Evaluate productivity for projecting deadlines.
	2.2 Work under pressure and tight deadlines.
	2.3 Organize the workload to meet with the timelines.
	2.4 Prioritize the tasks.
	2.5 Visualize a business idea end-to-end.
	2.6 Conceptualize an idea.
	2.7 Transform notions into business ideas.
	2.8 Write strong and effective emails for communication.
	2.9 Use digital tools like laptops, palmtops, mobiles, fax machines, printers, projectors, conferencing tools effectively.
	2.10 Strong understanding of emerging technologies.
	2.11 Good understanding of information security aspects.
	2.12 Convert textual content into graphs, images, charts, diagrams and flow charts.
3 Organize work efficiently by self-management and effective communication.	3.1 Exhibit personal vision and goals.
	3.2 Evaluate and monitor his/her own performance.
	3.3 Exhibit knowledge and confidence in your own ideas and vision.

	3.4 Articulate your own ideas and vision.
	3.5 Exhibit responsibility.
	3.6 Evaluate documents, drawings and recognize hazards in the work site.
	3.7 Plan workplace/ assembly location with due consideration to the operational stipulation.
	3.8 Communicate effectively with others and plan project tasks.
	3.9 Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
	3.10 Interact with stakeholders, whether it is internal in an organization or external with partners or clients, is fraught with opportunities for misunderstanding.
	3.11 Exhibit formal presentations and informal presentations during meetings.
4 Implement Continuous Professional Development (CPD) using emotional intelligence.	4.1 Exhibit professional development plan to enhance professional capabilities and interact successfully with colleagues and clients.
	4.2 Implement CPD to connect with people from different cultural backgrounds.

8. SYLLABUS

Syllabus for Advanced Diploma (Vocational) in "Automotive Technology"			
Core Module 1:Automotive Engineering Basics: 320 Hrs			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs.)**	**Professional Knowledge (Trade Theory) (96 Hrs.)**
1-19	Identify and choose safe working practices, environment regulations and house keeping	• Familiar with the institute and the other activities of DGT. **Skills on Work Safety in the Shop** • Make use of fire extinguishers • Carryout Safety Features and Emergency Procedures in the Shop. • Identify Vehicles Equipped with a supplemental Restraint System (SRS) and Antilock Brake System (ABS).	**Careers in the automotive field** • Opportunities in the automotive field, Training and certification, Job prospects in the automotive technology field, Common methods used to pay automotive technicians, facts about working as an automotive technician **Safety** • Protecting yourself and others in the Shop, use of PPE Equipment. Basic first aid ,use of fire extinguishers
20-43	Select and make use of various precision measuring instruments, determine the dimension of components and record the data	**Skills on Engineering Measurement** • Measure Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers • Measure the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer. • Measure valve spring free	**Measurement** • Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier callipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

		length use of vernier calliper • Measure cylinder bore for taper and out-of-round with Dial bore gauges.	
44-66	Interpret specifications, different engineering drawing and apply for different application in the field of work	**Skills on Engineering Drawing** • Read and interpret detailed and assembly (exploded view of) drawings of Air intake system components • Free hand sketching Drawing of I C engine and their parts. • Engine layouts - Layout of an automobile workshop	**Engineering drawing** • Refreshing on dimension-orthographic-isometric-sectional views- welding and machining symbols-Bill of materials- Blue –print drawing practices • Limits, Fits & Tolerances: - Definition of limits, fits & tolerances with examples used in auto components
67-87	Organize and carry out various metal testing methods, determine the values and compare with the standards	**Skills on Strength of Materials** • Carryout tensile testing and calculate required parameter • Measure the coil spring tension test of different load. Compare the stiffness value with standard value of given vehicle service manual • Measure the connecting rod bend and twist measurement using connecting rod alignment tester and Compare the bend and twist value with standard value of given vehicle service manual • Perform Torsion testing and calculate required parameter • Perform Fatigue testing and calculate required parameter	**Strength of materials** • Simple stress & strain-Hooke's law – Tensile and compressive stress- strain energy- lateral and liner strain-Poisson's ratio-factor of safety, riveted and welded joints- beams-torsion-bending moment concepts • A force of 600N is applied to a piston which has a cross-sectional area at the crown of 0.01m2, Calculate the pressure that this force creates in the gas in the cylinder • A front suspension spring of a certain vehicle is compressed by 30mm when it carries a load of 240 N. Calculate the spring stiffness (rate). • A connecting rod has a cross-

			sectional area of 200mm2 and it carries a compressive force of 2.4 tonnes. Calculate the compressive stress in the connecting rod. • Determine the strain energy stored in a valve spring that is compressed by 15mm under a load of 750 N.
88-119	Identify and explain the hydraulic and pneumatic components in the workshop and vehicles	**Skills on Fluid Power** • Tracing of hydraulic circuit on hydraulic jack • Tracing of hydraulic circuit in hydraulic power steering • Tracing of hydraulic circuit in Brake circuit • Identification of components in Air brake systems.	**Fluid power** • Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator).
120-168	Organize and measure various engine parameters (torque, BHP, BMEP,IHP etc.)	**Skills on Ratio and Proportion, Percentages** • Measure the engine speed and wheel speed at different gear and find the gear ratios • Measure piston dia and stoke length, determine swept volume and a clearance volume of Engine	**Ratio, proportion and percentage** • Basics of Raito and proportion, percentage calculations- Aspect ratio of tyres, Gear ratios – gearbox, calculation for Valve opening area, Wheel revolutions and distance travelled

		• Measure the vehicle speed and wheel speed and find the speed reduction percentage • Find the slip angle using slip tester. **Skills on IC Engine power** • Determine of the engine's effective torque (Te), at full and partial load conditions. Using Dynamometer • Determine of the engine's break mean effective pressure (BMEP) at full and partial load conditions. Using Dynamometer • Determine of the power (Pe) and break specific fuel consumption (bsfc) Characteristics at full and partial load conditions. Using Dynamometer • Determination of the engine's heat balance i.e. heat for power (Qe), heat rejected to cooling (Qwater), heat rejected to exhaust (Qexh) and heat rejected to overall friction (Qfriction). **Skills on Theoretical engine cycles** • Determine of the engine's volumetric efficiency (ηv) and relative air/fuel ratio (λ) at full and partial load conditions. Using Engine dynamometer.	• Calculate compression ratio of an engine that has a swept volume of 450cm3 and a clearance volume of 50cm3. • An engine that develops 120kW is tuned to raise the power output to 145 kW. Calculate the percentage increase in power • A poppet valve with a diameter of 40mm has a lift of 15 mm. Calculate the area through which air or mixture can pass on its way to the engine cylinder. • The rolling diameter of a large tyre for a commercial vehicle is 943.5 mm. How many metres will the vehicle move when the wheel and tyre rotate 10 times? **IC engine** • Brake power, Horsepower, Indicated power, Mean effective • Pressure, Cylinder pressures. crank angle, Mechanical efficiency of an engine, Volumetric efficiency, Brake mean effective pressure, Thermal efficiency, Indicated thermal efficiency, Brake thermal efficiency petrol vs. diesel • A certain engine develops a torque of 120Nm while running at a speed of 3000

			rev/min. Calculate the brake power. • A 4-cylinder, 4-stroke engine develops an indicated mean effective pressure of 8 bar at2800 rev/min. • The cross-sectional area of the cylinder bore is 0.01m2 and the length of the stroke is 150 mm. Calculate the indicated power of the engine in kW. • Certain engine develops a brake power of 120kW at a speed of 3000 rev/min. • At this speed, the indicated power is 140 kW. Calculate the mechanical efficiency of the engine at this speed. • A 4-cylinder 4-stroke petrol engine with a bore diameter of 100mm and a stroke of 110mm has a volumetric efficiency of 74% at an engine speed of 4000 rev/min. • Determine the actual volume of air at STP that flows into the engine in 1 minute. • During a 10-minute Dynamometer test on a petrol engine, the engine develops a brake power of 45kW and uses 3 kg of petrol. The petrol has a calorific value of 43 MJ/kg. Calculate the brake thermal

			efficiency. • During a dynamometer test, a certain 4-cylinder, 4-stroke diesel engine develops an indicated mean effective pressure of 8.5 bar at a speed 2000 rev/min. • The engine has a bore of 93mm and a stroke of 91 mm. • The test runs for 5 minutes during which time 0.8 kg of fuel are used. • The calorific value of the fuel is 43 MJ/kg. Calculate the indicated thermal efficiency. **Engine cycles** • Charles & Boyel's law-Otto-diesel cycle- constant pressure- constant volume, isothermal, Carnot cycle, Adiabatic and polytrophic process, calorimeter- Heat balance sheet of engines • Free hand sketching of Otto cycle, Diesel cycle. • Calculate: the indicated thermal efficiency; the air standard efficiency; the relative efficiency. • For a test engine used indicated power 50 kW, fuel used per hour = 15 kg. Calorific value of the fuel =43MJ/kg. Engine compression ratio = 8:1 • Calculate the air standard efficiency a certain diesel

			engine has a compression ratio of14:1. The fuelling factor ρ=1.78.
169-195	organize and carry out joining of metals using different methods and test for defects	**Skills on Manufacturing concepts and Industrial Engg** • Perform straight beads and Butt, Lap & T joints Manual Metal Arc Welding. • Setting of Gas welding flames, carryout a straight beads and joints Oxy – Acetylene welding	**Manufacturing concepts and industrial engineering)** • Casting defects- Welding defects-soldering and brazing Latent heat- EOQ-Inventory system, Heat Treatment process-Annealing, Normalizing, Hardening and tempering. • Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples.
196-220	check and interpret vehicle specification data and VIN and prepare a job card	**Skills on Vehicle Nomenclature** • Look for vehicle information Number from the vehicle and classify the data based on information obtained. **Skills on Customer relationship** • Prepare a sample work order	**Vehicle nomenclature** • Knowledge on Vehicle variants, Technical Specification, Vehicle Dimension, Identification of vehicle information Number (VIN). Use of Vehicle service information, using computerized information. **Customer relationship** • Proper customer relation procedures, Preparing a vehicle before and after service, familiar with the functions andComponents of a work order. • Use the three Cs (concern, cause, and correction) to diagnose the vehicleproblem.

221-320	Plan and perform various basic tests related with auto electrical and electronics and interpret the values obtained by comparing with the standards	**Skills on Basic Electrical** • Perform joining wires using soldering Iron. • Construction of simple electrical circuits. • Measure of current, voltage and resistance using digital multimeter. • Perform continuity test for fuses, jumper wires, fusible links, and circuit breakers. • Verify the correlation between conductor length and cross section. • Diagnose series, parallel, series-parallel circuits using Ohm's law. • Check electrical circuit with a test lamp. • Perform voltage drop test in circuits using multicentre. **Skills on Basic electronics** • Test power and signal connectors for continuity • Test different type of Diodes • Carryout NPN & PNP Transistors for its functionality • Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. **Skills on Instrumentation panel** • Diagnosis for combination meter warning light and take corrective action.	**Basic electrical** • Review of Electrical, Principles, OHM's Law-Power, Voltage, Current, resistance Calculations, Serious and Parallel circuit calculation, Use of multimeters • Fuses & circuit breakers: - Ballast resistor, stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series-parallel circuits, Capacitors and its applications, use of service manual wiring diagram for troubleshooting Capacitors in series and parallel. **Basic electronics** • Basic electronics: Description of Semiconductors, Solid state devices- Diodes, Transistors, Thyristors, Uni-Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches. **Dash board** • Study of various gauges/instrument on a dash board of a vehicle-Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as

			gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine-malfunction light.
	Project Work/ Industrial Visit		
	Revision		

Syllabus forAdvanced Diploma (Vocational) in "Automotive Technology"			
Core Module 2:Automotive Electrical and Electronics System - Diagnosis & Repair (320 hrs)			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs)**	**Professional Knowledge (Trade Theory) (96 Hrs)**
1-72	Plan and perform the trouble shooting, diagnosis of automotive electrical system, determine and solve the problems and justify the results	**Skills on Ignition system - petrol** • Carryout ignition spark test • Perform spark plug removal and installation • Inspect spark plug for air gap • Inspect ignition coil assembly and ignition timing and compare with reference value **skills on Starting System -petrol /diesel** • Remove starter motor from vehicle and performance test for pull in test, Hold in test, pinion return test, No-load performance test. • Carryout starter motor disassembly and reassembly • Perform Solenoid test for hold in coil open circuit, Armature Test-Ground test, open circuit test, pull-in coil open circuit test, field coil test, Inspection of brush length wear as per service manual. **Skills on Diagnosis for Starting System -petrol /diesel** • Diagnostic for starter motor does not run or run slowly • Diagnostic for starter motor runs but fails to crank engine • Diagnostic for starter motor abnormal noise **Skills on charging system**	**Ignition system** • Ignition principles , Spark plug components, Inductive system operation, Induction wiring, Hall effect sensors, Optical type sensors • Distributor less ignition systems, Insulated coils, Distributor less ignition system timing. **Starting system** • Purpose of starting system, Description of charging circuit, operation of alternators, regulator unit. • Description of starter motor circuit, Constructional details of starter motor solenoid switches. **Starting system diagnosis** • Common troubles and remedy in starter circuit. **Charging system** • The purpose of Charging system, Alternator principles, 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. **Charging system diagnosis** • Causes and remedy for

		petrol/diesel • Perform Generator test for No load check, load check • perform battery removal and installation • perform Generator drive belt tension inspection and adjustment • perform Generator drive belt removal and installation • perform Generator removal and installation • Carryout Generator disassembly and disassembly • Inspect Generator for rotor, slip ring diameter, bearing, stator, brush, exposed brush length, rectifier, regulator. **Skills on diagnosis for Charging system** • Troubleshooting for charge light does not light with ignition ON and engine off • Troubleshooting for charge light does not go out with engine running • troubleshooting for undercharged battery and overcharged battery • Troubleshooting for generator noise **Skills on Battery** • Perform Battery testing • Perform Battery recharging • Carryout Boost starting	charging system. **Battery** • Battery construction, Electrolyte, Charge and discharge processes, Technical battery figures and terms, Different battery types, Maintenance-free batteries, Installation positions of batteries in vehicle, procedure for safe handling of batteries. • Concept and working principle of Electric Vehicles, hybrid electric vehicle (HEV), Fuel cell–powered vehicles
73-180	Plan and perform the trouble shooting, diagnosis of automotive electronics and communication system, determine and solve the	**Skills on Engine Control Module (ECM)** • Carryout removal and installation of Engine Control Module (ECM) (follow the Exercise of procedure for registration of ignition key) • Register for ECM	**Engine control module** • Electronic control unit (ECU) - EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp. **Sensors**

	problems and justify the results	replacement procedure • Register for Fuel Injector Diesel vehicle • Carryout Air-fuel ratio date initialization for Diesel vehicle • Inspect Electric throttle body assembly On-Vehicle **Skills on testing of sensors** • inspect Accelerator Pedal position sensor On-Vehicle • Carryout removal, inspection and installation of Accelerator Pedal assembly with Accelerator Pedal position sensor. • Inspect Manifold Absolute sensor (MAP) and compare its reference value with service manual. • Carryout removal, inspection and installation of Engine Coolant Temperature (ECT) sensor. • Inspect On-Vehicle for Air fuel ratio (A/F) sensor, Heated Oxygen sensor (HO2S). • Carryout removal and installation of Air fuel ratio (A/F) sensor, Heated Oxygen sensor (HO2S). • Inspect On-Vehicle for Camshaft Position sensor (CMP) performance. • Carryout removal and installation of Camshaft Position sensor (CMP). • Inspect On-Vehicle for Crankshaft Position sensor (CKP) performance. • Carryout removal and installation of Crankshaft Position sensor (CKP).	• Description of 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 **Communication system** • Principle of multiplexing, different classes of communications, principle of operation of the Controller Area Network (CAN) bus system, principle of operation of the, LIN Bus system Media Oriented System Transport (MOST) data bus using fiber optics.

		• Inspect On-Vehicle for Vehicle speed sensor (VSS) performance. • Carryout removal and installation of Vehicle speed sensor (VSS). • Inspect On-Vehicle for knock sensor performance. • Carryout removal and installation of Knock sensor • Inspect On-Vehicle for Mass Air flow (MAF) sensor and Intake Air temperature (IAT) sensor. • Carryout removal and installation of Mass Air flow (MAF) sensor and Intake Air temperature (IAT) sensor. • Carryout removal and installation of Boost pressure sensor. • Inspect fuel pump relay, starting motor control relay, main relay and fuel heater relay. • Carryout removal and installation of Glow plug control module. **Skills on Communication Network system** • Diagnosis of CAN COMMUNICATION system symptoms and troubleshooting for last communication. • Trouble tracing in LIN, MOST BUS circuit. • Diagnose a body control module and module communication errors.	
181-239	Demonstrate troubleshoot and Diagnosis of vehicle safety	**Skills on Air bag system** • Perform Air bag diagnosis using "on-board diagnostic system".	**Air bag** • Description of the different types of air bag system sensors.

	system	• check for Air bag warning light • Diagnosis for "AIR BAG" Warning light comes ON steady and take corrective action. • Diagnosis for "AIR BAG" Warning light does not come ON take corrective action. • Perform repair and inspection after accident as per procedure. • Perform disabling air bag system. • Perform enabling air bag system. • Carryout removal, inspection and installation of Forward impact sensor.	• Description of normal operation of the air bag system warning light. • Procedure for disabling and enabling air bag system • Function of the side-impact air bags and the locations of the modules and sensors
240-290	Plan and organize the trouble shooting, diagnosis of automotive electrical accessories, determine and solve the problems and justify the results	**Skills on Horn system** • Carryout removal, inspection and installation of Horn. **Skills on Wiper/Washers** • Diagnosis for wiper not working and take corrective action. • Diagnosis for washer not working and take corrective action. • Carryout removal, inspection and installation of Wiper tank and washer pump. • Carryout removal, inspection and installation of Windshield wiper. • Inspect windshield wiper motor operation. • carryout removal, inspection and installation of rear wiper • Inspect rear wiper motor operation. • Carryout removal, inspection and installation of wiper and	**Horn** • Working principle of Horn and horn switch. **Wiper** • Description of Wiper, wiper motor, Types of windshield wiper systems. **Glass/windows /mirror** • Description and working principle of power window, power mirror, and power door lock.

		washer switch. **Skills on Glass/windows /mirror** • Diagnosis for rear end door window defogger does not operate and take corrective action. • Diagnosis for all power windows do not operate and take corrective action. • Diagnosis for only one power window do not operate and take corrective action. • Diagnosis for abnormal noise in power window do not operate and take corrective action. • Diagnosis for power window does not moves smoothly and take corrective action. • Inspect for rear end door window defogger switch, relay and defogger wire. • Repair rear end door window defogger wire. • Inspect for power window main switch.	
291-320	Demonstrate troubleshoot and Diagnosis of vehicle safety system.	**Skills on power door lock system symptom diagnosis** • Diagnosis for all doors cannot be locked /unlocked by all of switches and take corrective action. • Diagnosis for all doors cannot be locked /unlocked by only power door lock switch and take corrective action. • Diagnosis for all door cannot be locked /unlocked by only key cylinder switch and take corrective action. • Diagnosis for only one door cannot be locked/unlocked	**power door lock system** • Causes and remedy for door lock system. **keyless entry system** • Principle of keyless entry system and its advantages.

		and take corrective action. **Skills on keyless entry system symptom diagnosis** • Diagnosis for all door cannot be locked /unlocked by only keyless entry transmitter and take corrective action. • Diagnosis for interior light does not light when doors are unlocked by keyless entry transmitter and take corrective action. • Diagnosis for hazard warning lights do not light when doors are locked/unlocked by keyless entry transmitter and take corrective action. • Diagnosis for transmitter code cannot be programmed to ECM and take corrective action.	
	Project Work/ Industrial Visit		
	Revision		

Syllabus for Advanced Diploma (Vocational) in "Automotive Technology"			
Core Module 3:Automotive Engines System-Diagnosis & Repair (320 hrs)			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs)**	**Professional Knowledge (Trade Theory) (96 Hrs)**
1-22	Plan and organize the troubleshooting and diagnosis of intake and exhaust system.	**Skills on Intake system** • Check air cleaner filter condition, clean and Replace if excessive dirty filter as per reference to service manual. • Carryout Removal, inspection and installation of Air cleaner assembly(follow the procedure of Removal of Battery, MAP sensor, EVAP canister purge valve) • Carryout Electric throttle body assembly removal, inspection and Installation(follow the procedure of cooling system draining, Removal and installation of air cleaner assembly) • Carryout removal, inspection, and installation of intake manifold with new gasket. (follow the procedure of Removal and installation of throttle body, MAP sensor)	**Intake system** • Engine Shop safety, Principals of service station setup, Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material. Handling of related tools-use of Air blow gun, application of special tools required for the Engine &. • If air cleaner element becomes clogged, Cleaning/Replacement interval • What is an idle mixture, if idle mixture is wrong, inspection /Adjustment interval • Torques specification chart for various maintenance activities. coolant and Gasket specification
23-130	Plan and organize the troubleshooting and diagnosis of power plant (Engine: Construction, Petrol, Diesel)	**skills on Cylinder Head Cover Assembly** • Perform Removal, inspection and installation of cylinder head cover and tighten as per order and torque specification(follow the procedure of Removal and installation of air cleaner assembly, ignition coil assembly While installing	**Cylinder Head Cover Assembly** • Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets and water tight sealant specification. **Engine Camshaft**

		Install new spark plug hole gasket, cylinder head cover gasket, apply water tight sealant as per service manual) **Skills on Engine Camshaft Assembly** • Perform camshaft and tappet removal as per service manual procedure with special tool applicable to Engine manufacture.(follow the procedure of Removal and installation of cylinder head cover) • Carryout camshaft and tappet inspection and reference with service manual specification to take decision on replacement, as camshaft height, camshaft run out, camshaft journal wear, camshaft journal clearance, camshaft journal diameter, camshaft journal housing bore, camshaft housing thrust clearance, wear of tappet, measure cylinder head to tappet clearance, tappet outside diameter and cylinder head tappet bore **Skills on Engine disassembly and reassembly** Perform Engine assembly removal and installation as per service manual procedure. • Carryout valves and cylinder head disassembly and reassembly. • Measure valve stem diameter, valve guide bore and valve stem-to guide	• Description and function of camshaft, procedure for Inspection and measuring parameter as per manual, Description of drives, Description of Overhead camshaft, importance of Cam lobes. • Use of Micrometer, dial gauge, gauging plastic, cylinder bore gauge. **Engine disassembly and reassembly** • Procedure for dismantling of engine from a vehicle. • Engine assembly procedure with aid of special tools and gauges used for engine assembling. **petrol Engine performance** • Procedure to be followed while carryout compression and Engine vacuum test **Timing chain cover** Description and function of the fly wheel and vibration damper. Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel. • What is a timing belt, Importance of changing timing belt(Timing chain is not replaced periodically.), If timing belt breaks, Replacement interval**.** **Engine Valve and Cylinder head Assembly** • Valves & Valve Trains-Description and Function of Engine Valves, different types, • Type of valve operating

		clearance and compare with service manual specification. • Measure valve stem end deflection limit, valve protrusion length, valve head radial run out, seating head contact width. • Inspect EGR passage, venturi plug. • Inspect cylinder head for distortion head surface on piston side, intake and exhaust manifold side and cylinder head bolt. • Inspect valve spring and measure valve spring free length, valve spring preload, valve spring squareness. **Skills on piston assembly** • Perform piston, piston ring, connecting rod and cylinder removal inspection and installation(follow the Exercise of removal and installation of Engine Assembly, cylinder head) • Carryout Perform piston, piston ring, connecting rod and cylinder disassembly and reassembly • Inspect cylinder and measure cylinder bore diameter, cylinder taper and out-of-round and compare with service manual ref values • Inspect piston and measure piston diameter, piston clearance, ring groove clearance and compare with service manual ref values • Inspect piston ring and measure piston ring end gap	mechanism, Valve- timing diagram, valve and cylinder components inclusive DOHC (Double overhead valve camshaft, concept of Variable valve timing. • Use of special tool as valve guide remover, valve lifter, What is valve clearance, Excessive valve clearance, Insufficient valve clearance, Inspection/Adjustment interval. **Piston** • Description & functions of different types of pistons, piston rings and piston pins. • Recommended clearances for the rings and its necessity precautions while fitting rings, Compression ratio, use of special tools piston ring compressor. **connecting rod** Description& function of connecting rod, importance of big- end split obliquely, piston pins and locking methods of piston pins. **crankshaft Assembly** Description and function of Crank shaft, Firing order of the engine, Inspection and measuring parameter as per manual **CRDI Diesel Engine Intercooler components** Description and function of Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system • Description & function of exhauster, Super charger, Intercoolers

		and take decision if replace is necessary. • Inspect piston pins and connecting rods and measure piston pin clearance in connecting road small end, piston pin clearance in piston, small end bore, piston pin diameter and piston bore. **Skills on connecting rod Assembly** • Inspect for connecting rod alignment, connecting rod bolt deformation and measure connection rod big-end side clearance. • Inspect crank pin and connecting rod bearing and measure crank pin diameter, crank pin taper and out-of-round. • Inspect connecting rod bearing and measure connecting rod bearing clearance and select suitable bearing as per manual. • Perform removal, inspection and installation of Main bearing, crankshaft and cylinder block and maintain tightening torque as per service manual specification. **Skills on crankshaft Assembly**Inspect crankshaft and measure crankshaft run out, crankshaft thrust play, crankshaft out-of-round and taper. • Inspect main bearing and measure main bearing clearance and selection of main bearing as per	

		specification. • Inspect cylinder block and measure for cylinder block flatness. **Skills on CRDI Diesel Engine Intercooler components** • Perform removal and Installation of Intercooler (follow the Exercise of Removal and installation of Front bumper). • Carryout vacuum pump removal and installation. (Follow the Exercise of Removal and installation of Air cleaner assay). • Inspect vacuum pressure and compare with vacuum pressure specification. **Skills on petrol Engine performance** Check compression pressure on all cylinders and verify with the standard compression pressure as per service manual. • Perform Engine vacuum check and verify with Vacuum specification. • Inspect oil level, oil quality and oil leaks if any. • Remove and replacement of oil pressure switch. • Inspect oil pressure and compare with oil pressure specification as stated in manual. • Check valve clearance as per specification if not and adjust it to desired specification. **Skills on Timing chain cover** Carryout timing chain cover	

		removal, inspection and installation, check oil seal and replace if necessary (Follow the procedure of removal & installation of Engine assembly from vehicle, water pump, oil pan, Oil pump strainer, oil pump). • Perform flywheel removal inspection and installation. • Perform timing chain and chain tensioner removal, inspection, and installation. **Skills on Engine Valve and Cylinder head Assembly** • Carryout valve and cylinder head removal, inspection and installation (Follow the procedure of removal & installation of Engine assembly, oil pan, Oil pump strainer, cylinder head cover, timing chain cover, timing chain, camshaft and tappet, exhaust manifold, Fuel injector, oil pump).	
131-153	Plan and perform the trouble shooting, diagnosis of automotive emission control system, determine and solve the problems and justify the results.	**Skills on EGR Valve and EGR cooler components** Perform EGR Valve and EGR cooler removal and installation(follow the Exercise of Removal and installation of Glow plug, cooling system draining, ECM, Cowl Top Garnish components) **Skills on Crankcase ventilation system components** Carryout Oil separator and crank case ventilation cover removal, inspection and installation(follow the Exercise of Removal and installation of ECM, Cowl Top Garnish components, Generator/Alternator).	**EGR Valve and EGR cooler components** Types of emissions: Description of Evaporation emission control, Catalytic conversion, Crankcase emission control, Exhaust gas recirculation (EGR) valve. **turbocharger Assembly** Description & function of turbo charger, variable turbo charger mechanism.

		Skills on turbocharger Assembly • Carryout turbocharger removal, inspection and installation ((follow the Exercise of Removal and installation of Air cleaner assembly, intercooler, Exhaust manifold components, glow plug, oil cooler, exhaust muffler, Air fuel ratio sensor, catalytic convertor) • Inspect turbocharger for abnormal noise and excessive run out and measure stroke of boost control valve.	
154-199	Plan and organize the troubleshooting and diagnosis of cooling and lubricating system.	**Skills on Engine Lubrication system** Check oil level in pan if oil level is low add oil up to full level mark on oil level gauge. • Inspect oil Quality if is discoloured or deteriorated, change it, Ref service manual (follow the Exercise of Engine oil change and filter change). • Check for oil leak if any. • Check oil pressure and reference with service manual specification (Ref the exercise of removal and installation front Bumper components). • Use of special tools as oil pressure gauge. • Change the Engine oil and filter. • Inspect oil pressure sensor switch on-vehicle. • Carryout oil pan & oil pump strainer removal and installation and follow the	**Lubrication system** Function of lubrication system, Viscosity and its grade as per SAE, • Importance of engine oil change, Engine oil roles, Replacement interval, Types of engine oil. • Procedure for strainer replacement, engine oil filter roles, if the engine oil filter is not replaced, Replacement interval. • Procedure for Engine oil and filter change, use of special tool as oil filter wrench, oil level gauge. • Different type of Oil pump & Oil filters, importance of Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler. **Cooling System** Description of Engine Cooling systems, block diagram of coolant circulation routing, Vehicle coolant properties and

		torque tightening value as per service manual (Ref Exercise of Removal and installation of Exhaust system components, oil filter). • Carry out oil pump disassembly and reassembly. • Inspect oil pump for oil seal, relief valve and measure radial clearance between rotor and case for oil pump, side clearance for oil pump inner rotor, rotor plate clearance, relief valve spring free length and load as per service manual. **Skills on Engine Cooling System** • Check coolant level if coolant level is low add specified coolant up to FULL mark level. • Inspect drive belt for tension, cracks, cuts, deformation, wear, if any defect found replace the belt. • Inspect Engine cooling system and cleaning and ref with service manual specification of cooling system and radiator cap holding pressure. • Perform cooling system draining. • Perform cooling system Flush and refill. • Carryout cooling water pipes/Hoses removal and installation. • Carryout thermostat removal and installation(follow the exercise for cooling system	recommended change of interval, If coolant leaks out, 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. • Purpose of drive belt, If drive belt is damaged, Inspection interval. • Use of pressure tester gauge • Procedure for cooling system Flush and refill. • **Use of Scan Tool**

		draining, ECT sensor removal cooling system Flush and refill) • Inspect thermostat temperature at which valvebegin to open, become fully open and thermostat valve lift. • Inspect Radiator cooling fan assembly on-vehicle. • Check for radiator for leakage or damage, straighten bent fins, if any • Carryout Radiator Removal and installation(follow the exercise of follow the exercise for cooling system draining, ECT sensor removal cooling system Flush and refill) • Carryout Radiator cooling fan assembly removal and installation. (follow the exercise Radiator Removal and installation) • Perform water pump removal, inspection and installation and follow the torque tightening value as per service manual. • Inspect Radiator cooling fan low speed control system check. • Radiator cooling fan high speed control system check.	
200-277	Formulate and perform the troubleshooting and diagnosis of Electric and Electronic related to power plant MPFI and CRDI.	**Skills on CRDI Engine performance** • Glow plug removal and installation • Glow plug control module removal and installation. • Check compression pressure on all four cylinders and verify with the standard	**CRDI Engine performance** • Procedure for carryout compression pressure. **CRDI Engine Disassembly and reassembly** • Procedure for dismantling of diesel engine from a vehicle. **Fuel system -MPFI** • Basic EFI principles block

		compression pressure as per service manual. • Common rail removal and installation. • check timing between camshafts and crankshafts **Skills on CRDI Engine Disassembly and reassembly** **Skills on Fuel system -MPFI** • Inspect fuel pressure and compare with service manual (use of Fuel pressure gauge). • Inspect for fuel cut operation for MPFI (use of stethoscope). • Check for fuel efficiency norms against the recommendation of the manufacturer • Perform fuel pressure relief. • Check for fuel leakage if any. • Carryout fuel pipe removal and installation (follow the exercise of fuel pressure relief). • Inspect fuel injector on-vehicle (use of stethoscope). • Check resistance of fuel injector ref with service manual specification. • Carryout fuel injector removal, inspection and installation (follow the exercise of fuel pressure relief, removal and installation of air cleaner assembly. • Inspect fuel injector for injected fuel volume and fuel leakage and compare with the reference value (follow the exercise of fuel	diagram of fuel delivery system, Routing, Air supply, Air volume, Multi-point injection systems (MPI/MPFI), Simultaneous injection, efficient combustion. **Fuel pump and fuel tank assay** • Description and function of Fuel pumps, Fuel filters, Tanks & lines, Fuel lines, Fuel rail, Fuel pressure regulator, Injectors, Tachometric relay, Thermotime switch, EFI sensors, Potentiometer, Auxiliary air valves, Idle speed control devices, Inertia sensors. • What is a fuel tank cap, Importance of inspecting the fuel tank cap, Inspection interval. **CRDI fuel Injector system** • Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology & Clean diesel technology.

		pressure relief, use of special tool and scan tool). **Skills on fuel pump and fuel tank assay** • Inspect fuel filler cap. • Perform Fuel tank removal, inspection and Installation (follow the exercise of fuel pressure relief, removal and installation of Exhaust pipe and muffler, use of hand operated pump). • Inspect fuel tank for leaks, deterioration and damage. • Perform fuel tank purging procedure. • Inspect fuel pump on-vehicle. • Carryout fuel pump assembly removal and installation (follow the exercise of Fuel tank removal, inspection and Installation). • Inspect fuel pump assembly for damage, dirt and contamination. • Check fuel level sensor resistance and reference with service manual specification. • Perform fuel filter removal and installation. **Skills on Fuel system CRDI** • Perform fuel pressure relief on-vehicle (use of scan tool). • Check for fuel leakage. • perform water draining of fuel filter • Perform air bleeding of fuel system. • Carryout high-pressure pipe removal and installation (follow the exercise of fuel	

		pressure relief on-vehicle, removal and installation of intercooler, use of special tool for tightening as per torque specification). **Skills on CRDI fuel Injector system** • Perform fuel injector removal and installation as per service manual procedure (follow the exercise of high-pressure pipe removal and installation) • Carryout common rail removal and installation (follow the exercise of fuel pressure relief on-vehicle, high-pressure pipe removal and installation) • Carryout high pressure pump removal, inspection and installation. (follow the exercise of fuel pressure relief on-vehicle, removal and installation of air cleaner assembly, vacuum pump, high-pressure pipe removal and installation) • Perform fuel temperature sensor removal and installation. • Inspect fuel temperature sensor and fuel filter water detection sensor and compare with service manual specification.	
278-301	Plan and organize the troubleshooting and diagnosis of intake and exhaust system.	**Skills on Exhaust system** • Check Exhaust system as periodic maintenance for rubber mountings, leakage, dent, loose connection, ground clearance • Carryout Exhaust Manifold	**Exhaust system** • Description and function of Exhaust manifold, Exhaust pipe, Extractors, Mufflers-Reactive, absorptive, Combination., Catalytic converters

		removal, inspection and installation for MPFI (follow the exercise of removal of A/F sensor, O2 sensor) • Perform Exhaust pipe and muffler removal, inspection and installation • Carryout Exhaust Manifold removal, inspection and installation for CRDI. (follow the procedure of cooling system draining, Removal and installation of air cleaner assembly, turbocharger). • Carryout catalytic converter removal inspection and installation	• Procedure for Manifold fitment, sensors location, diagnosis procedure for turbo charger noise. • What is a charcoal canister, Importance of inspection of charcoal canister, Inspection interval.
302-311	Plan and perform the trouble shooting, diagnosis of automotive emission control system, determine and solve the problems and justify the results	**Skills on Aux Emission control devices** • Inspect EVAP canister purge system using scan tool. • Inspect EVAP canister purge valve and measure its resistance value with service manual. • Inspect EVAP Canister for vacuum passage. • Insect PCV valve and hose.	**Aux Emission control devices** • Description of Evaporation emission control (EVAP),What is a PCV valve,, Importance of inspection of PCV valve, Inspection interval.
312-320	Plan and organize the troubleshooting and diagnosis of power plant (Engine: Construction, Petrol, Diesel)	**Skills on Engine diagnosis** • Diagnosis for Engine overheating and take corrective action. • Diagnosis for Unusual noise from engine and take corrective action. • Diagnosis for Engine not cranking and take corrective action. • Diagnosis for engine crank but not start and take corrective action. • Diagnosis for Excessive engine vibration (oil mix	**Engine diagnosis** • Causes and remedy for Engine diagnosis for 1) Engine overheating (2) Unusual noise from engine (3) Engine not cranking (4) engine crank but not start (5) Excessive engine oil consumption (6) Excessive engine vibration (oil mix with coolant) (7) low fuel mileage (8) Poor pickup (9) excessive smoke from exhaust(10) excessive white smoke (11) Low oil pressure (12) poor engine running (13) Engine stops

		with coolant) and take corrective action. • Diagnosis for poor fuel mileage and take corrective action. • Diagnosis for Poor pickup and take corrective action. • Diagnosis for excessive smoke from exhaust and take corrective action. • Diagnosis for excessive white smoke and take corrective action. • Diagnosis for Low oil pressure and take corrective action. • Diagnosis for Engine stops immediately after starting and take corrective action. • Diagnosis for Engine misfire after starting and take corrective action. • Error code analysis and corrective action.	immediately after starting (14) Engine noise (15) Engine misfire
	Project work/Industrial visit		
	Revision		

Syllabus for Advanced Diploma (Vocational) in "Automotive Technology"			
Core Module 4:Automotive Transmission Diagnosis & Repair (320 hrs)			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs)**	**Professional Knowledge (Trade Theory) (96 Hrs)**
1-150	Plan and organize to find the faults and Diagnosis of manual Transmission system and suggest appropriate measure for manual transmission, transaxle, differential and final drive.	**Skills on Clutch Assembly** • Check for clutch pedal height and compare with the desired specification as per service manual. • Check for clutch pedal free travel and compare with the desired specification as per service manual. • Adjust clutch cable as per desired specification as per service manual. • Carryout removal, inspection and installation of clutch cable. • Inspect clutch cable and replace if damaged. • Carry out removal, inspection and installation of clutch pedal assembly.(follow the exercise of removal, inspection and installation of clutch cable). • Carryout removal, inspection and installation of clutch cover and clutch disc. (follow the exercise of manual transaxle unit dismounting and remounting). • Inspect clutch disc for rivet head depth and ref with service manual specification. • Inspect clutch cover for diaphragm spring damage or wear and inspect pressure plate for heat spots and replace if any damage.	**Clutch Assembly** • Clutch principles, Single-plate clutches, Multi-plate clutches, Dual mass flywheels, Operating mechanisms, Clutch cable replacement condition **Clutch hydraulic type** • Principle of Hydraulic clutch type, Description of Pressure plate, Driven/ center plate, Throw-out bearing. **Clutch diagnosis** • Causes and remedy for clutch system 1. Clutch vibrates, 2. clutch fail to disengage, 3.clutch noisy 4. Clutch slippage 5. Clutch chatter 6. Pedal is hard to operate. 7. Spongy clutch pedal **Manual transaxle unit** • Description of Transaxle designs, Gearbox operation, Baulk-ring synchromesh unit, Transaxle synchromesh unit. **Gearbox assembly** • Gearbox layout & operation- Gearbox layouts **Transmission Diagnosis** • **Causes and remedy for transmission system**

		• Carryout removal, inspection and installation of clutch release system. • Check clutch release bearing for smooth operation. • Check clutch release shaft and its pin for bend and damage and replace if necessary. **Skills on clutch hydraulic type** • Carryout removal, inspection and installation of clutch pedal position switch. • Inspect CPP switch resistance and compare with reference value. • Inspect clutch pedal height and adjust it the desired range. • Inspect clutch cylinder push rod play and adjust it the desired range. • Inspect clutch pedal free travel and adjust it the desired range clutch fluid level. • Inspect clutch fluid level. (follow the exercise of brake fluid level inspection). • Carryout air bleeding of clutch system. • Carry out removal, inspection and installation of clutch fluid pipe. • Carry out removal, inspection and installation of clutch master cylinder (follow the exercise of removal, inspection and installation of clutch fluid pipe). • Carry out removal, inspection and installation of clutch operating cylinder. (follow the exercise of manual transaxle unit dismounting and remounting)	

		• Inspect clutch operating cylinder for clutch fluid leakage, spring damage and bearing for smooth operation, if not working replace the clutch operating cylinder. **Skills on diagnosis for Clutch** • Diagnosis for clutch vibration and take corrective action. • Diagnosis for clutch fail to disengage and take corrective action. • Diagnosis for noisy clutch and take corrective action. • Diagnosis for clutch slipping and take corrective action • Diagnosis for Clutch chatter and take corrective action. • Diagnosis for Pedal is hard to operate and take corrective action. • Diagnosis for Spongy clutch pedal and take corrective action. **Skills on Manual transaxle unit** • Carryout manual transaxle unit dismounting and remounting (follow the exercise of removal and installation of Engine Assembly, front drive shaft, starting motor). • Carryout removal, inspection and installation of gear shift and select shaft assembly. • Carryout disassembly and reassembly of gear shift and select shaft. **Skills on Gearbox assembly** Carryout gear box disassembly and reassembly as per procedure. • Carryout input shaft and counter shaft assembly disassembly and reassembly	

		as per procedure. • Carryout differential disassembly and reassembly as per procedure and check for gear thrust play. **Skills on transmission Diagnosis** • Diagnosis for Gears slipping out of mesh and take corrective action. • Diagnosis for Gears Hard shifting take corrective action. • Diagnosis for Gear noise and take corrective action.	
151-320	Examine/interpret the faults in Diagnosis of automatic Transmission system and suggest appropriate measure for automatic Gear boxes.	**Skills on Inspection and Testing on Auto transmission** • Perform inspection, testing, and diagnosis procedures on automatic transmissions / transaxles. • Perform visual inspection. • Inspect fluid level and condition. • Interpret road test results. • Perform on board diagnostics and analyse data • Access applicable service information / technical service bulletins. • Adjust linkage. • Interpret hydraulic pressure test results. • Carryout power flow trouble. • Perform shift evaluation. • Carryout symptom based diagnosis of transmission / component failures • Diagnosis for specific component failure and causes **Skills on service and repair of Automatictransmission/transaxle** • Carryout disassembly sequence. • Perform air test.	**Auto transmission** • Automatic Transmissions-, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters. Different type of hybrid power train, Alternate fuel power train -Electrical car; **Service and repair of Automatic transmission /transaxle** • Layout & operation for P,R,N&D (1st & 2nd) Selector positions, Planetary gear set, High range power flow, Low range power flow Servos & clutches-Rear servo, Front servo, One way clutch, Multi-plate front clutch, Clutch pack, Rear clutch. **Automatic transmission / transaxle electronic controls.** • Description of Electronic control Unit, Fully hydraulically controlled transmission, Electronic shift programs, Manual

		• Perform required measurements. • Inspect and adjust to the manufacturers specific corrections. • Disassemble transmission / transaxle. • Inspect components • Trace power flow through unit. • Disassemble and inspect sub components. • Re-assemble and verify correct function. • Change automatic transmission fluid and filters. • Perform flushing of assemblies. **Skills on automatic transmission / transaxle electronic controls.** • Inspect power train control units (PCU). • Inspect input devices (sensors) speed, position, pressure, temperature. • Inspect output devices (solenoids, relays) pressure, shift, torque converter clutch controls (TCC). • Inspect data lines / communications. • Carryout on board diagnostics. **Skills on interpret results of functional and diagnostic tests on automatic transmission / transaxle electronic controls** • Perform component testing. • Carryout scan tool utilization. • Perform performance testing. • Test pressure controls. • Test shift controls. **Skills on Drive shaft /Axle**	selection. **Diagnosis of automatic transmission / transaxle electronic controls** • Description of Continuously variable transmission (C.V.T.)- Drive or reverse, The steel belt, Secondary pulley shaft **Drive shaft /Axle** • 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 • Description of Four-wheel drive shafts, Four-wheel final drive, Four-wheel drive transfer case, Freewheeling hubs, Four-wheel drive differentials • Description of Rear-wheel final drives, Rear-wheel drive differentials, Limited slip differentials. **Drive shaft /Axle** • Trouble shooting causes and remedy for 1. Excessive vibration at low gear or certain speed, 2. premature wear 3. Slip joint spline wear/tube broken. • Shaft support on bearing/rubber insulator wear or fracture. • Trouble shooting causes and remedy for Differential: 1. Pion and crown alignment with

		• Carryout front drive shaft assembly on-vehicle inspection for. • Boots for breakage leaks, tear • Boots bands for loose, crack • Drive shaft for crack or damage. • Check differential side joint for smooth rotation. • If any damage the same may be replaced. • Perform removal, inspection and installation of front drive shaft assembly. • carryout front drive shaft disassembly and reassembly as per service manual procedure • carryout removal, inspection and installation of Front wheel hub, steering knuckle and wheel bearing.(follow the exercise of removal and installation of Brake disc) • Carryout removal, inspection and installation of Rear wheel bearing. **Skills on diagnosis for Drive shaft /Axle** • Diagnosis for abnormal noise and take corrective action. • Diagnosis for Excessive vibration at low gear or certain speed and take corrective action. • Diagnosis for premature wear and take corrective action • Diagnosis for Slip joint spline wear/tube broken and take corrective action. • Diagnosis for shaft support on bearing/rubber insulator wear or fracture and take corrective	proper clearance 2. Humming noise.

		action. • Diagnosis for Pion and crown alignment with proper clearance and take corrective action. • Diagnosis for Humming noise and take corrective action.	
	Project work / Industrial visit		
	Revision		

Syllabus for Advanced Diploma (Vocational) in "Automotive Technology"			
Core Module 5 :Automotive Vehicle Controls- Brake, Suspension and Steering - Diagnosis &Repair (320 hrs)			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs)**	**Professional Knowledge (Trade Theory) (96 Hrs)**
1-95	Plan and organize to find the faults and Diagnosis of vehicle controls (conventional) and suggest appropriate measure for brake, suspension and steering system.	**Skills on Brake system** • Inspect brake fluid level, brake fluid level switch and change the brake fluid if required. • Carryout air bleeding of brake system. **Skills on brake pedal assembly** Carryout removal, inspection and installation of brake pedal assembly. • Check for brake pedal free height and adjust it to the desired standard as per service manual. • Inspect excessive brake pedal travel and adjust it to the desired specification. • Carryout removal, inspection and installation of brake light switch and adjust it if required **Skills on brake master cylinder assembly** • Carryout removal, inspection and installation of brake hose and pipe. • Check brake hose for deplete, crack, and damage if any defect found replace it. • Check brake pipe for crack, dent and corrosion if any defect found replace it. • Carryout removal, inspection and installation of Master cylinder assembly.	**Brake system** Principles of braking, Brake lines, Brake fluid, air Bleeding. **Brake pedal assembly** Description of Brake pedal, Brake light switch. **Brake master cylinder assembly** • Description of Master cylinder, Divided systems. **Front Brake components** • Description of Power booster or brake unit, Hydraulic brake booster, Electro hydraulic braking (EHB), Applying brakes, Brake force, Description of Brake pad, Regenerative braking. • Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake calipers, proportioning valves, Proportioning valve operation, Brake friction materials. **Rear Brake**

		• Carryout removal, inspection and installation of Master cylinder reservoir. • Inspect master cylinder assembly for No-load inspection and Air tightness inspection (use of special tools). • Check for brake booster function. **Skills on Brake Booster** • Check for Air tightness, operation, Air tightness under loaded condition. **Skills on Front Brake components** • Inspect front brake pad lining thickness of outside and inside pads and refer with service manual specification and replace if worn out • Carryout removal, inspection and installation of front brake pad.(follow the exercise of removal and installation of wheel) • Carryout removal, inspection and installation of front brake disc.(follow the exercise of removal installation of front brake pad). • Inspect front brake disc deflection (use of special tools), front brake disc thickness, front brake pad lining thickness and compare with service manual value. • Carryout removal, inspection and installation of front brake caliper. • Carryout disassembly and	Description of Drum brake system, Drum brake operation, Brake linings & shoes, • Principles of ABS braking, ABS master cylinder, Hydraulic control unit. **Wheel cylinder Assembly** Description of Wheel cylinders, Back plate. **Parking brake** Brake type - principles, Air brakes, Exhaust brakes, Electric brakes, Parking brakes, Engine brakes, Regenerative braking.

		assembly of front brake calliper. • Check for piston seal. • Inspect for calliper body and carrier for deformation crack, rust and damage, if defective replace. • Check cylinder boot for brake fluid leak. • Inspect calliper slide pin for its smooth movement in thrust direction. **Skills on Rear Brake** • Inspect rear brake shoe lining thickness on-vehicle and compared with specified value if less replace all brake shoe • Carryout removal, inspection and installation of rear brake drum.(follow the exercise of removal and installation of rear wheel bearing, wheel with tire, parking brake adjustment) • Inspect brake drum for crake, wear and damage if any defect found replace brake drum • Measure brake drum inner diameter and compare with ref value specified in service manual • Inspect brake shoe lining for hardening, wear, peel-off and oil. • Measure thickness of brake shoe lining thickness diameter and compare with ref value specified in service manual • Inspect ABS Sensor ring for damage if any. • Carryout removal, inspection and installation of rear brake	

		shoe.(follow the exercise of removal, inspection and installation of rear brake drum, wheel with tire, parking brake adjustment) • Check for rear brake shoe adjuster and shoe lever for wear and damage if any. **Skills on wheel cylinder Assembly** • Carryout removal, inspection for wear, cracks, corrosion, fluid leakage, if any defect found replace wheel cylinder, and installation of wheel cylinder. (Follow the exercise of removal, inspection and installation of rear brake shoe, air bleeding of brake system, parking brake adjustment). • Carryout removal, inspection and installation of brake back plate. (Follow the exercise of removal, inspection and installation of wheel cylinder, air bleeding of brake system, parking brake adjustment). **Skills on Parking brake** • Carryout parking brake inspection for operation, rear wheel locking, parking brake stroke and adjust it. • Carryout removal, inspection and installation of parking brake cable.(follow the exercise of removal, inspection and installation of rear brake shoe, consol box components) • Carryout removal, inspection and installation of parking brake lever. (follow the	

		exercise of removal, inspection and installation consol box components). • Inspect parking brake switch for function.	
96-131	Examine/interpret the faults in Diagnosis of vehicle control system (advanced) and suggest appropriate measure for antilock brake and power steering.	**Skills on ABS Systems** • Diagnostic and repair in Antilock Brake System circuit. • Diagnostic and repair in Electronic Stability Program (ESP) system circuit. **Skills on ABS symptom diagnosis** • Diagnosis for ABS warning light turns ON after engine start and take corrective action. • Diagnosis for ABS warning light does not turns on for 2 sec after ignition switch has turned ON and take corrective action. • Diagnosis for ABS warning light flashes and take corrective action. • Diagnosis for EBD warning light lights after engine start and take corrective action. • Diagnosis for EBD warning light does not turns on for 2 sec after ignition switch has turned ON and take corrective action. **Skills on diagnosis for braking stability (20 hrs)** • Diagnosis for less braking force and take corrective action. • Diagnosis for brakepull and take corrective action. • Diagnosis for excessive pedal	**ABS Systems** • Description of Wheel speed sensors, ABS with EBD electronic control unit. Read ABS and ESP circuit diagram **ABS symptom diagnosis** • Use of Scan Tool, study (DTC) Diagnostic Trouble Code **Diagnosis for braking stability** • Causes and remedy for Braking system

		travel and take corrective action. • Diagnosis for brake locked and take corrective action • Diagnosis for brake warning light lights after engine start and take corrective action. • Diagnosis for brake warning light turn on when brake is applied and take corrective action. • Diagnosis for brake warning light fails to turn on when parking brake is applied and take corrective action.	
132-242	Plan and organize to find the faults and Diagnosis of vehicle controls (conventional) and suggest appropriate measure for brake, suspension and steering system.	**Skills on Suspension system** • Check suspension frame and arm for deformation, crack and damage. • Check front& rear shock absorber for oil leakage, deformation, damage if any and play and tightening. • Check front& rear Coil spring crack and damage if any and play and tightening. • Check bushes for crack and damage. • Check suspension arm joint for play and suspension arm joint dust cover for crack. **Skills on wheel alignment** • Carryout front wheel alignment inspection with a diagnostic equipment, interpret and take corrective action and adjust to desired specification • Perform Toe-Inspection and adjustment of toe angle. • Inspect camber caster and	**Suspension system** • Principles of suspension, Types of suspension-Suspension systems, Description, function and advantages of non-independent suspension Independent suspension, Rear independent suspension, Rear-wheel drive independent suspension, electronically controlled air suspension (ECAS), Adaptive air suspension operation. • Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs. **Wheel alignment** • 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,

		kingpin inclination angle. • Inspect steering angle and adjust it to the desired specification. **Skills on strut Assembly** • Carryout front strut Assembly removal, inspection for strut for oil leakage, damage. • Inspect coil spring seat for cracks and distortion, inspect rebound stopper, strut bearing, strut dust cover, and strut support for wear, cracks and distortion. If any abnormality replace with new one, and installation. • Carryout strut assembly and disassembly and reassemble. (Use of special tool). • Carryout removal, inspection and installation of suspension arm (follow the Exercises of removal and installation front bumper components, removal and installation of wheel). • Check suspension arm for damage, inspect bush for wear, damage, check joint cover for crake and damage, if any abnormal replace. • Perform suspension arm bush disassembly and assembly (Use of special tool). • Perform suspension arm dust cover disassembly and assembly. • Carryout rear wheel alignment inspection and adjust to desired specification.	Thrust angle &centerlines **Strut Assembly** • principle of Mc person Strut suspension, Short/long arm suspension, Torsion bar suspension Rear suspension types & components-Rigid axle leaf spring suspension, Rigid axle coil spring suspension, Independent type suspension, Rigid non-drive suspension **Shock absorber** • 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 **Wheel balancing and tyre rotation** • Wheel types & sizes, Rim sizes & designations, Types of wheels, Tyres, Tyre pressure monitoring systems, Run flat tyres, Space-saver tyres, Tyre rotation. Descriptions Tire wear Patterns and causes **Diagnosis for suspension system** • Causes and remedy for suspension system **Steering system**

		Skills on shock absorber • Carryout rear shock absorber removal, inspection for shock absorber upper bush for wear, crack and damage, oil leakage if any defect found replace it. and installation. • Carryout rear coil spring and spring seat removal, inspection. • Check for rear coil spring for crack, damage, check spring seat for crack and damage, if defect found replace it and installation. **Skills on wheel balancing and tyre rotation** • Carryout wheel with tyre removal, inspection – check wheel disc for dent, crack and distortion, check tyre for uneven or excessive wear and damage and installation as per manual. • Perform wheel balancing. • Carryout tyre rotation. **Skills on Diagnosis for suspension system** • Diagnosis for vehicle pulls and take corrective action. • Diagnosis for abnormal or excessive wear and take corrective action. • Diagnosis for wheel tramp and take corrective action. • Diagnosis for shimmy, shake or vibration and take corrective action. • Diagnosis for abnormal noise,	• 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. Procedure for centering contact coil cable Assembly. • Description and function of Steering columns.

		front end and take corrective action. • Diagnosis for Body leans in corners and take corrective action. • Diagnosis for cupped tyres and take corrective action. **Skills on steering system** • Check steering column capsules, steering column length and compare with service manual specified value and if out of specification replace it. • Carry out removal, inspection and installation of steering wheel assembly (follow the exercise of disabling Air bag system, removal and installation of driver Air bag module, Enabling Air bag system) (use of special tool) • Carry out removal, inspection and installation of steering contact coil Cable assembly (follow the exercise of removal, inspection and installation of steering wheel assembly. • Carryout centering contact coil cable Assembly • Carry out removal, inspection-check for steering column for operation and damage, and installation of steering column as per procedure (follow the exercise of removal, inspection and installation of steering wheel assembly, contact coil cable, immobilizer control module. • Carryout removal, inspection and installation of ignition	

		switch cylinder. (follow the exercise of disabling air bag system, immobilizer control module, enabling air bag system, registration of the ignition key). • Carryout removal, inspection and installation of steering lock/ ignition switch assembly. (follow the exercise of removal and installation of steering column, registration of the ignition key). • Carryout removal, inspection and installation of steering lower shaft**.**	
243-278	Examine/interpret the faults in Diagnosis of vehicle control system (advanced) and suggest appropriate measure for antilock brake and power steering.	**Skills on power assisted steering** • Check steering wheel play and steering force compare with desired value. • Carryout removal, inspection and installation of tie-rod end. (follow the exercise of removal and installation of wheel with tyre, front wheel alignment). • Carry out removal, inspection – check boot for tear , if any damage replace it, and installation of steering gear case assembly (follow the exercise of removal and installation of front suspension frame). • Carry out removal, inspection and installation of tie-rod / rack boot (follow the exercise of removal and installation of steering gear case assembly). • Carryout removal, inspection – check rack plunger for wear or damage, check rack plunger spring for deterioration and installation of steering rack plunger. (follow the exercise	**Power assisted steering** • Power Assisted steering, Steering process, Flow-control valve, Electric power assisted steering, Basic electric power steering operation, Procedure for inspection of steering wheel play and steering force, Description of Rack-and-pinion gearbox, Helix, Variable ratio steering, Worm gearbox. **Diagnosis for steering** • Causes and remedy for steering system and use of scan tool for power steering and study of DTC code related to power steering.

		of removal and installation of steering gear case assembly). **Skills on diagnosis for steering** • Diagnosis for hard steering and take corrective action. • Diagnosis for rack and pinion noise and take corrective action. • Diagnosis for too much plays in steering and takes corrective action. • Diagnosis for hard steering and take corrective action.	
279-320	Evaluate driving performance of trainees.	**Skills on Driving** • Obtaining LLR License. • Driving exercise – orientation. • Driving exercise - limit braking. • Driving exercise - lane change. • Driving exercise - brake in a turn. • Driving exercise - Graphing the USG. • Driving exercise - Avoidance maneuver. • Driving exercise - Wet skid pad. • Driving exercise - Baseline path. • Driving exercise - Path variation. • Driving exercise - Low pressure evaluation. • Driving exercise - Lapping in comparison vehicle.	**Driving** • Instruction to Driving exercise - orientation , limit braking, brake in a turn, lane change, Wet skid pad, Low pressure evaluation.
	Project work / Industrial visit:		
	Revision		

Syllabus for Advanced Diploma (Vocational) in "Automotive Technology"			
Elective Subject 1:Automotive Air Conditioning and Climate Control System: Diagnosis and Repair (320 hrs)			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs)**	**Professional Knowledge (Trade Theory) (96 Hrs)**
1-16	Demonstrate Diagnosis of automotive air conditioning and climate control system.	**Skills on A/C performance** • Inspect A/C system performance and compare with the desired value	**A/C principles** • Air-conditioning principles, Air-conditioning capacity, A/C flow block diagram
17-146	Plan and organize the troubleshooting and diagnosis of automotive air conditioning and climate control system components.	**Skills on Diagnosis for A/C system** • Diagnosis on High pressure Gauge. • Diagnosis for pressure is higher than acceptable range in "H" area and take corrective action. • Diagnosis for pressure is lower than acceptable range in "I" area and take corrective action. • Diagnosis Low pressure Gauge. • Diagnosis for pressure is higher than acceptable range in "J" area and take corrective action. • Diagnosis for pressure is higher than acceptable range in "K" area and take corrective action. • Diagnosis for abnormal pressure and take corrective action. • Diagnosis for blower motor does not operate and take corrective section. • Diagnosis for Air outlet port does not change even if air flow selector is changed and take corrective section • Diagnosis for Air intake door	**Diagnosis for A/C system** • Causes and Remedy for A/C system

		does not change even if intake mode is changed and take corrective section. • Diagnosis for warm air does not come out and take corrective section • Diagnosis for No cool air comes out or A/c compressor does not operate and take corrective section. • Diagnosis for No cool air comes out or radiator Cooling fan motor does not operate and take corrective action • Diagnosis for insufficient cooling and take corrective action. • Diagnosis for cool air comes out only at high speed and take corrective action. • Diagnosis for abnormal noise from compressor and take corrective action. • Diagnosis for abnormal noise from Magnetic clutch and take corrective action. • Diagnosis for abnormal noise from condenser assembly and take corrective action. • Diagnosis for abnormal noise from A/c Evaporator and take corrective action. • Diagnosis for abnormal noise from Blower motor and take corrective action. • Carryout Inspection of HVAC control unit and its circuit • Carryout A/C system inspection at ECM.	
147-320	Demonstrate Diagnosis of automotive air conditioning and	**Skills on Refrigerant Charge** • Follow the local Govt regulation working with refrigerator systems.	**A/C Air intake actuator** • Description of Air intake control actuator • Description of Pressure

	climate control system.	• Perform refrigerant charge as per procedure. • Check A/C system for pressure leaks. • Check A/C system for refrigerant leaks. **Skills on Radiator** • Carryout removal, inspection and installation of Radiator cooling fan. **Skills on Condenser Assembly** • Carryout removal, inspection and installation of condenser assembly. • Carryout removal, inspection and installation of HVAC unit • Carryout removal, inspection and installation of blower motor. • Carryout removal, inspection and installation of blower motor resistor. **Skills on evaporator Assembly** • Carryout removal, inspection and installation of evaporator temperature sensor. • Carryout removal, inspection and installation of expansion valve. **Skills on HVAC sensors** • Carryout removal, inspection and installation of HVAC control unit. • Inspect for blower speed selector. • Inspect for A/C refrigerant pressure sensor and its circuit. • Carryout removal, inspection	switches, Heating elements, procedure for adjust compressor drive belt tension **A/C Compressor** • Description and working principle of Air-conditioning compressors function of Fixed orifice, Control devices, Temperature monitoring thermostat.

		and installation of A/C Refrigerant pressure sensor. **Skills on A/C Air intake actuator** • Carryout removal, inspection and installation of Air intake control actuator. • Carryout removal, inspection and installation of centre, side, passenger side ventilation louver. • Inspect for A/c switch, HVAC system relay. • Inspect and adjust compressor drive belt tension. **Skills on A/C Compressor** • Carryout removal, inspection and installation of Compressor drive belt. • Carryout removal, inspection and installation of Compressor assembly. • Carryout removal, inspection and installation of Magnetic clutch. • Carryout removal, inspection and installation of relief valve.	
	Project Work/ Industrial Visit		
	Revision		

Syllabus for Advanced Diploma (Vocational) in "Automotive Technology"			
Elective Subject 2:Auto body Repair and Refinishing (320 hrs)			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs)**	**Professional Knowledge (Trade Theory) (96 Hrs)**
1-28	Organize and analyze the misalignment of the body due to an accident, estimate the amount of repair to be carried out and propose for repairing of vehicle body.	**Skills on Vehicle Information** • Detect of different type body, chassis. • Detect the location of parts and panels. • Perform to extract vehicle data and measurement details from computer-based service information, service manuals, refinishing guides, vehicle dimension manual. colour matching guides, parts interchange guides. • Utilize colour matching guides. • Utilize of parts interchange guide. **Skills on Accident Report** • Inspect Damage vehicle and accident report Preparation. • Detect the location of damaged parts and panels. • Perform Parts replacement list. • Preparation of repair estimate information by using an estimating 6 hrs)guide book.	**Vehicle body** • Description of vehicle Body and Chassis. • Definition of body shop, classification of body shop-Independent body shop, dealership body shop, specialty body shop and repair order • Study of Service Information, basic steps to refinishing material. • Vehicle paint code, study of service symbols, diagnosis charts, wiring diagram. **Body collision** • Definition of collision, impact of collision and collision repair measurement. • Preparation of repair estimate information by using an estimating guide book. • Description of estimate, Direct repair programs, Estimate time factor, work orders, Using Estimate Guides, Part prices, Labor costs, Job overlap, and included operation.
29-176	Plan and organize to carry out the body alignment work and	**Skills on Measuring of Body and Frame Damage** • Measure dimension of upper	**Measuring of Body and Frame Damage** • Measurement of Body

	perform the welding processes to make the body perfect for riding.	body, front body, body side panel, rear body using trame gauge. • Measure Damage Using Gauge measuring system. • Perform on analyzing damage- Length damage, Width damage, Height damage. • Repair for front-end damage, rear damage, side damage, sag damage, twist damage, diamond damage, straightening strut, tower damage, stress relieving, straightening strut tower damage, stress relieving with heat, stress concentrators. • Perform anchoring the vehicle using pulling clamps and chains and with the aid of Frame Straightening Equipment. • Perform computerized measuring system. **Skills on Compressor Air System** • Carryout Overhauling of Air Compressor. • Monitoring and servicing of Units associated with compressor. **Skills on Welding System** • Carryout MIG, Spot, Tack welding technique on auto body panels. • Carryout Gas welding on joining of sheet metals. • Carryout Soldering and Brazing on joining of cut bumper or any auto components. • Perform on Plasma Cutting on damaged body panel.	Dimensions, Gauge Measuring System, Tram Gauges, Digital Tram Gauges, Centering gauges • Gauge measuring system- frame gauge, upper body dimensioning, measurement of the front body, measurement of the body side panel, measurement of the rear body, digital tram gauges, dimensional references, the centre panel, zero planes, diagnosing damage, measuring Vehicle Impact and Its Effects on a vehicle, Visually Determining the Extent of Impact Damage. • Realignment basics-vehicle anchoring and pulling, pulling direction, single-pull method, multiple-pull Method, visualizing front-end Collisions, rear-end collisions, side collision, rollover damage, angled impacts. • Unibody/Frame Straightening Equipment, in-floor straightening equipment-anchor-pot system and the modular rail frame system. portable body and frame pullers, rack (floor) straightening systems, bench straightening systems, anchoring the vehicle using pulling clamps and chains, other straightening accessories-restraint bar , door aligner, engine holder, portable hydraulic rams, strut plate,

		Skills on Refinishing System • Carryout on hand sanding block to prepare smooth surface for repair. • Prepare surface area and apply filler on damaged area. • Carryout painting on body panel with aid of grits , masking tapes, refinishing materials-Paint binders, solvents, additives, sealants, • Repair of scratches on body panel. • Prepare rust free surface and corrosion treatment of interior & exterior surface for paint process. **Skills on Door Repairs** • Straighten damage on a door using a hammer and dolly pry out a fender to allow for hammer straightening using long spoon to remove small dents in hard-to-reach areas using Pry picks. • Pull out minor damage using dent puller. • Remove dents in steel Panels using a spot weld dent puller. • Remove door and detect the door assembly parts. **Skills on Hood** • Remove Hood and adjustment to hinge, latch, height adjustment and re-fixing. **Skills on Fender** • Remove fender adjustment	straightening and realigning techniques-sequence for a total structure realignment procedure • Computerized measuring systems, procedure for planning the pull, making pulls-single-pull setup, multiple-pull setups, executing a pulling sequence, purpose of over pulling. **Compressor Air System** • Basic requirement of Compressor System, Types of Compressor, Air and Fluid Control System, Study of Hose, Connectors, Adaptors, • Piping arrangement for body shop, colour coding for different pipe lines. **Welding System** • Common Auto body welding technique, Auto body MIG welding principals and characteristics, Spot welding techniques, Oxyacetylene welding, Soldering and Brazing procedure, Advantages of different welding methods • Plasma cutting and operating procedure **Body Refinishing System** • Description of Body fillers, filler ingredients, types, properties, mixing of filler, surface preparation, Rubbing and polishing compound. • Refinishing Materials, Description and types of

		and repair, install • Service Grille, trunk lid repair and trunk bed service **Skills on Windshield** • Remove and refit, rubber gasket service, apply adhesive using sealer gun. **Skills on Repair of Plastic Parts** • Repair minor cracks and cuts using adhesives and bonding techniques. • Reshape plastic parts by heat technique.	Sealer, Primer and Topcoat Paints. Abrasives, grit, grit rating, grit types, wet and dry sanding. • Description of Corrosion, anticorrosion material, basic surface preparation, treatment, exposed joints, interior and exterior surface.
177-320	Plan and organize to carry out the body painting work and perform the finishing work.	**Skills on Paint Mixing** • Carryout Paint Mixing. • Practice on measure viscosity of paint mix using ford cup. **Skills on Spray Gun Application** • Adjust spray knobs, spray pattern, Gun Stroke, maintain Gun Speed, Triggering, Gun direction and Spray overlap. • Carryout Spray Pattern • Top Heavy or Bottom Heavy. • Heavy to Right or Left • Heavy at Center • Split pattern • Carryout spray Gun repairing for Sags, runs, leaks, air leaks. • Perform Paint Spray Booth maintenance. **Skills on Repairing of Paint Surface for work** • Check Paint Thickness. • Remove paint using Chemical stripping, Media blasting. • Perform colour evaluations using sunlight & colour	**Automotive paint** • Topcoat Paints, content of paints, curing, flash point, accelerator, catalyst, adhesion promoter. • Different ways to mix paint or other materials paint mixing sticks, viscometer, or viscosity cup, effect on finish- material temperature, film thickness, Automobile Painting Process. **Spray Gun Application** • Description of Spray Gun and its parts, Atomization, High volume low pressure gun, Types of air spray gun and their paint feed method. Advantages and disadvantages of spray gun. • Spray gun setup- Air Supply, Adjustments, Distance, Adjustment Knobs, Testing Spray Pattern, effect of spray gun stroke, gun speed, triggering, direction, spray

		corrected light bulb. • Perform matching Basic Paint Colours. • Carryout Spraying Metallic Colours. • Repair with a multistage mica or pearl finish. • Matching Custom paint using Spectrophotometer or electronic colour Analyzer, Computerized Paint mix.	overlap, Description of Paint booth, types and working procedure, Usage of Respirators. **Repairing of Paint Surface for work** • Importance of surface preparation, Evaluate Surface Condition, Checking Paint Thickness, Paint Removal method • Functions of paint, OEM paint finishes procedures, different between OEM and refinish painting types of paint for topcoat refinishing, properties of paint used for refinishing. Topcoats, Prime coats, Pre-painting Preparations, Applying Prime coats, Basic Spray Coats Basecoat/Clear coat Repairs, Applying Single Stage Paints, Panel Repairs, Overall Refinishing, Removal of Masking • Introduction, Colour Theory, Lighting-colour evaluations using sunlight & colour corrected light bulb, dimensions of colour-Value—lightness or darkness, Hue—color, cast, or tint, Chroma—saturation, richness, intensity, or muddiness, standard colour chips, variance colour chips, Matching Basic Paint Colours- use of colour test panel, spray-out test panel procedure • Spraying Metallic Colours-Wet Coats of Metallic

			Colour, Dry Coats of Metallic Colour. • Spectrophotometer or electronic colour Analyzer, Computerized Paint Matching Custom painting. • Repairing Paint Problems- problems in wet paint, removing foreign matter in wet paint, wet sanding between coats, Causes, prevention and correcting of - paint colour mismatch, orange peel, runs and sags, sand scratch swelling, bull's-eye featheredge , featheredge splitting, water spotting, chemical spotting, curing or drying failure, paint fish-eyes, blushing, bleeding, prime coat show-through, blistering, solvent popping, paint cracking, line checking, crazing, micro checking, lifting, paint wrinkling, mottling, pin holing, peeling, chalking, paint colour fade, dulled finish, debris in the finish, rust under the finish.
	Project Work/ Industrial Visit:		
	Revision		

Syllabus for Advanced Diploma (Vocational) in "Automotive Technology"			
Elective Subject 3:Automotive Two Wheeler – Diagnosis and repair(320 hrs)			
Hour No.	**Reference Learning outcome**	**Professional Skills (Trade Practical) (224 Hrs)**	**Professional Knowledge (Trade Theory) (96 Hrs)**
1-54	Plan and organize to carry out maintenance and overhauling of different types of engines in two and three wheelers, determine its functionality and its performance.	**Skills on Body panels** • Carryout front fender removal and installation. • Carryout seat removal and installation. • Carryout shroud removal and installation. • Carryout removal and installation body cover/ Tail cover. • Carryout removal and installation of fuel tank cover. • Carryout removal and installation of Head Light assembly. • Carryout removal and installation of rear inner fender. • Carryout removal and installation of drive chain cover. • Carryout removal and installation of exhaust pipe/muffler. **Skills on troubleshooting of Exhaust system** • Excessive exhaust noise • Poor performance **Skills on two-wheeler Maintenance system** • Inspect throttle operation performance. • Measure the throttle grip free play at the grip flange, If the free play is out of specification	**Body panels** • Safety precaution for handling tools. • Description of Motor cycle body panels and their parts. **Troubleshooting of Exhaust system** • Causes and remedy for Exhaust system. **On two wheeler Maintenance system** • Description of different type of maintenance and its schedule. • Measuring/ inspection parameter as per manual. **Engine Diagnosis** • Causes and remedy for Engine trouble.

		adjust the throttle. • Carryout removal and installation of air cleaner, Replace the element if it is excessively dirty or damaged. • Check the crankcase breather hose for deterioration, damage or leakage. • Carryout removal, inspection and installation of spark plug. • inspect spark plug, Clean the spark, Measure the spark gap, If necessary, adjust the gap as per specification • Inspect, Check each valve clearance and adjust inlet and exhaust valve clearance as per specification. • inspect Engine oil level and replace, if required as per manual • check the engine idle speed & adjust it as per manual, If is necessary • inspect drive chain slack & adjust it as per specification, If is necessary, • perform cleaning, Lubrication and inspection of drive chain • Inspect the drive and driven sprocket teeth for wear or damage, replace them if necessary. • carryout removal and installation of drive chain • Check the brake pads for wear. • Check the front and rear brake fluid level, and ensure that the brake fluid level is between the limit. • Inspect break and brake pedal height and adjust it as per specification, If is necessary. • Adjust the headlight beam	

		• Measure the clutch lever free play and adjust it as per specification, If is necessary. • Check the side stand springs for damage or loss of tension. • Check the action of the forks by operating the front brake and compressing the front suspension several times. • Check the action of the rear shock absorbers by compressing them several times. • Measure the tread depth at the center of the tires. Replace the tires when the tread depth reaches the limit. • Check that the handlebar moves freely from side to side. **Skills on Engine Diagnosis** • Engine cranks but won't start (No MIL blinking). • Engine cranks but won't start (No fuel pump operation sound when turning the ignition ON). • Engine stalls, hard to start, rough idling. • Backfiring or misfiring during acceleration. • Poor performance (drivability) and poor fuel economy. • Engine idle speed is below specifications. • Engine idle speed is above specifications.	

55-101	Plan and organize to find the faults and Diagnosis of vehicle electrical and electronics and suggest appropriate measure for its functionality.	**Skills on Sensor inspection** • Check EOT (Engine Oil Temperature) sensor • check TP (Throttle position) sensor • Check IAT (Intake Air Temperature) sensor. • Check fuel injector. • Check O2 (Oxygen)sensor malfunction. • Check Bank angle sensor. • Carryout Removal, inspection and installation of ECM. **Skills on Diagnosis of Ignition system.** • Trouble shoot for No initial voltage with the ignition switch turned ON • Trouble shoot for Initial voltage is normal, but it drops by 2 – 4 V while cranking the engine. • Trouble shoot for Initial voltage is normal but there is no peak voltage while cranking the engine. • Trouble shoot for Initial voltage is normal but peak voltage is lower than the standard value. • Troubleshoot for Initial and peak voltages are normal but no spark jumps. **Skills on service of Ignition system** • Check Ignition coil primary Peak voltage, record and compare it with the specified value. • Check CKP (crankshaft position) sensor peak voltage. • Carryout removal and installation of Ignition coil. • Check ignition timing.	**Sensors** • Description of different type of sensors and Testing procedure used in motor vehicle. **Ignition system** • Causes and remedy for ignition system trouble. **On service of Ignition system** • Description of Ignition system and its components. **Diagnosis for Electric Starter system** • Causes for remedy for Starter system trouble. **Service of Electric Starter system** • Description of Starter motor function and its assembly components. • Inspection procedure for testing of starter motor.

		Skills on diagnosis for Electric Starter system • Trouble shoot for Starter motor does not turn • Trouble shoot for Starter motor turns only when the transmission is in neutral. • Trouble shoot for Starter motor turns only when the transmission is in any gear with the side stand retracted and clutch lever pulled in • Troubleshoot for Starter motor turns slowly. • Troubleshoot for Starter motor turns, but engine does not turn. • Trouble shoot for Starter relay switch "Clicks", but engine does not turn over. **skills on service of Electric Starter system** • Carryout removal, inspection and installation of starter motor. • Perform disassembly and reassembly of starter motor. • Check the oil seal of the front cover for deterioration or damage, and needle bearing for wear or damage. • Clean the metallic debris off between commutator bars. • Replace the armature with a new one if necessary. • Check for continuity between pair of commutator bars • Check for continuity between each commutator bar and the armature shaft • Check for continuity between the insulated brush and cable	

		terminal • Check for continuity between the insulated brush and rear cover. • Carryout removal, inspection and installation starter relay. • Inspect starter ground line circuit. • Inspect starter power line circuit.	
102-173	Plan and organize to carry out maintenance and overhauling of different types of engines in two and three wheelers, determine its functionality and its performance.	**Skill on fuel system** • Perform fuel pressure test, If the fuel pressure is out of specified, inspect the following: - Fuel line - Fuel pump unit - Fuel filter and confirm to the desired specification • Perform fuel flow inspection and confirm to the desired specification • Carryout removal and installation of fuel tank. • Carryout removal and installation of fuel filter/Fuel pump unit. • Carryout removal and installation of Air Cleaner housing. • Carryout removal and installation of fuel injector • Carryout removal, inspection and installation of EVAP purge control solenoid valve. • Carryout removal, inspection and installation of EVAP Canister. **skill on Diagnosis for lubrication**	**Fuel system** • Description of Fuel system and its components, • Description of working principle of air cleaner, fuel injector and EVAP system **Diagnosis for lubrication system** • Causes and remedy for lubrication system trouble **Service of lubrication system** • Need of lubrication system and its components **Diagnosis for cylinder head and valves** • Causes and remedy for cylinder head and valve trouble. **Service of cylinder head and valves** • Procedure for carrying out compression test. • Description of cylinder head and its assembly components. • Measuring/ inspection parameter of cylinder head and valve as per manual. **on diagnosis for Engine**

		system • Diagnosis for Engine oil level too low. • Diagnosis Oil contamination. **skill on service of lubrication system** • carryout removal, inspection and installation of oil pump • perform disassembly, inspection and assembly of oil pump • Inspect the following parts for damage, abnormal wear, deformation or burning. - Oil pump driven gear - Oil pump shaft - Lock pin - Inner rotor - Outer rotor - Oil pump body • Measure the oil pump clearances according to Lubrication system specifications, If any of the measurement is out of the service limit; replace the oil pump as an assembly. • Perform removal and installation of Oil pump drive Gear. • Clean Engine oil centrifugal filter. **Skills on diagnosis for cylinder head and valves** • Diagnosis for Compression too low, hard starting or poor performance at low speed. • Diagnosis for Compression too high, overheating or knocking. • Diagnosis for Excessive smoke. • Diagnosis for Excessive noise.	**cylinder/piston** • Causes and remedy for engine cylinder /piston trouble. **Service of cylinder/piston** • Description of cylinder and piston and its assembly components. • Measuring/ inspection parameter of cylinder and piston as per manual.

		• Diagnosis for Rough idle. **Skills on service of cylinder head and valves** • Perform cylinder compression test. • Carryout removal, inspection and installation of camshaft/Rocker arm. • Carryout removal, inspection and installation of cylinder head. • Inspect the following parts for damage, abnormal wear, deformation, burning or clogs in oil passages. - Cylinder head - Valve spring - Valves - Valve guides and Measure each part and clearance according to cylinder head/valve specifications, Replace any part if it is out of service limit. • Perform valve guide replacement. • Inspect valve seat/refacing. • Carryout removal, inspection and installation of cam chain tensioner. **Skills on diagnosis for Engine cylinder/piston** • Diagnosis for Compression too low, hard starting or poor performance at low speed. • Diagnosis for Compression too high, overheating or knocking. • Diagnosis for Excessive smoke. • Diagnosis for Abnormal noise.	

		Skills on service of cylinder/piston • Carryout removal, inspection and installation of the cylinder and piston with the engine installed in the frame. • Replacement of the cylinder stud bolts if required. • Inspect the following parts for scratch, damage, abnormal wear, deformation, burning or clogs in oil passages. - Cylinder - Piston - Piston rings - Piston pin • Connecting rod small end and measure each part and calculate the clearance according to cylinder/piston specifications and replace any part if it is out of service limit.	
174-195	Plan and organize to carry out maintenance and overhauling of different types of transmission in two and three wheelers, determine its functionality and its performance.	**Skills on diagnosis for clutch and gearshift linkage** • diagnosis for Clutch slips when accelerating • diagnosis for Motorcycle creeps • diagnosis for Hard to shift • diagnosis for Transmission jumps out of gear • diagnosis for Gearshift pedal will not return **Skills on service of the clutch and gearshift linkage** • Carryout removal, inspection and installation of right crankcase cover can be serviced with the engine installed on the frame. • carryout replacement of crankshaft bearing • carryout removal, inspection	**diagnosis for clutch and gearshift linkage** • Causes and remedy for clutch and gearshift trouble **on service of the clutch and gearshift linkage** • Function of clutch and its assembly components. • Measuring/ inspection parameter of clutch as per manual.

		and installation of clutch. • carryout manual clutch disassembly and disassembly • Inspect the following parts for scratch, damage, abnormal wear and deformation. Replace if necessary - Clutch lifter bearing - Clutch springs - Clutch center - Clutch discs/plates - Clutch outer - Clutch outer guide - Main shaft - Centrifugal filter rotor - Primary drive gear and measure each part according to clutch/Gearshift linkage specification, replace any part if it is out of service limit • Replace the clutch springs as a set. • Replace the clutch discs and plates as a set. • Carryout removal, inspection and installation of gearshift linkage. • Inspect the following parts for scratch, damage, abnormal wear and deformation. Replace if necessary. - Gearshift spindle - Gearshift arm spring - Gearshift arm - Gearshift spindle oil seal and measure each part according to clutch/Gearshift linkage	

		specification, replace any part if it is out of service limit	
196-208	Plan and organize to find the faults and Diagnosis of vehicle electrical and electronics and suggest appropriate measure for its functionality.	**Skills on service of Alternator/ Starter clutch** • Carryout removal, inspection and installation of Left crankcase cover. • Carryout removal, inspection and installation of stator. • Carryout removal, inspection and installation of flywheel. • Carryout disassembly and assembly of starter clutch. • Inspect the following parts for scratch, damage, abnormal wear and deformation. Replace if necessary. - Starter driven gear - Rollers, springs and starter clutch outer - Starter reduction gear and shaft - Starter driven gear needle bearing and measure each part according to Alternator/starter clutch specification, replace any part if it is out of service limit	**service of Alternator/ Starter clutch** • Description of Alternator and starter clutch • Measuring/ inspection parameter of Alternator and starter clutch as per manual
209-244	Plan and organize to carry out maintenance and overhauling of different types of transmission in two and three wheelers, determine its	**Skills on diagnosis for crankcase/transmission/crankshaft system** • Diagnosis for gear Hard to shift • Diagnosis for Transmission jumps out of gear • Diagnosis for Excessive noise	**Diagnosis for crankcase/transmission/crankshaft system** • Causes and remedy transmission trouble. **service of crankcase/crankshaft system**

	functionality and its performance.	**Skills on service of crankcase/crankshaft system** • Carryout separation of Crankcase from the motor cycle • Carryout removal, inspection and installation of crankshaft • Inspect the following parts for scratch, damage, abnormal wear and deformation. Replace if necessary. – Connecting rod – Timing sprocket and measure each part according to crankcase/crankshaft/transmission balancer specification replace any part if it is out of service limit • Measure the side clearance by inserting the feeler gauge between the crankshaft and connecting rod big end compare with the specified value • Measure the crankshaft - connecting rod big end radial clearance and compare with the specified value • Measure the crankshaft run out using a dial gauge at specified location as per service manual and compare with the specified value • Replace the crankshaft if the outer race does not turn smoothly, quietly, or if inner race fits loosely. • Replace crankshaft bearing **Skills on servicing of transmission system** • Carryout removal, inspection and installation of transmission	• Description of crankshaft and connection rod , timing sprocket. • Measuring/ inspection parameter for crankshaft as per manual. **servicing of transmission system** • Description of working principle of transmission system and its assembly components. • Measuring/ inspection parameter for transmission system as per manual. **servicing of Engine** • Procedure for removal and installation of engine.

		system • Inspect the following parts for scratch, damage, abnormal wear and deformation. Replace if necessary. - Transmission gears - Transmission bushings - Transmission bearings - Shift drum/journal - Shift forks - Shift fork shaft - Main shaft - Countershaft - Gear shift spindle journal - Oil passages and measure each part according to transmission specification replace any part if it is out of service limit • Replace transmission bearing. **Skills on servicing of Engine** • Carryout removal, inspection and installation of Engine.	
245-274	Plan and organize to find the faults and Diagnosis of vehicle controls and suggest appropriate measure for brake, suspension and steering system.	**Skills on diagnosis for Front wheel/ Suspension /steering** • Diagnosis for Hard steering • Diagnosis for Steers to one side or does not track straight • Diagnosis for Front wheel wobbles • Diagnosis for Front wheel turns hard • Diagnosis for Soft suspension • Diagnosis for Hard suspension • Diagnosis for Suspension noisy **Skills on servicing of Front wheel/ Suspension /steering**	**Diagnosis for Front wheel/ Suspension /steering** • Causes and remedy for front wheel / suspension trouble **Servicing of Front wheel/ Suspension /steering** • Description of different type of suspension. • Measuring / inspection parameter for front wheel / suspension. **Diagnosis for Rear wheel/ Suspension /steering**

		• Carryout removal, inspection and installation of Front wheel • Inspect the following parts for damage, abnormal wear, deformation, looseness, smoothly operation or bend. - Front axle - Wheel rim - Wheel bearing • Carryout removal, inspection and installation of fork • Perform disassembly, inspection and assembly of fork unit • Inspect the following parts for damage, abnormal wear, bend, deformation and scoring. - Fork pipe - Outer tube - Slide bushing - Guide bushing - Back up ring • Remove and install Handle bar • Carryout removal and installation of steering stem **Skills on diagnosis for Rear wheel/ Suspension /steering** • Diagnosis for Steers to one side or does not track straight • Diagnosis for Rear wheel wobbling • Diagnosis for Wheel hard to turn • Diagnosis for Soft suspension • Diagnosis for Stiff suspension • Diagnosis for Rear suspension noisy **Skills on servicing of Rear wheel/ Suspension /steering** • Carryout removal, inspection	• causes and remedy for rear wheel / suspension trouble **Servicing of Rear wheel/ Suspension /steering** • Measuring / inspection parameter for rear wheel / suspension. **Diagnosis for Brake system** • Causes and remedy for brake system trouble. **Service of Brake system** • Description of brake system and its assembly components. • Measuring/inspection of parameter for brake system as per manual.

		and installation of rear wheel • Inspect the following parts for damage, abnormal wear, deformation, looseness, smoothly operation or bend. - Rear axle - Wheel rim - Tire - Wheel and driven flange bearings - carryout removal, inspection and installation shock absorber • Visually inspect the shock absorber for wear or damage. • Check the following: - Damper rod for bend or damage - Damper unit for deformation or oil leaks - Bushings for wear or damage - Rubber bumper for wear or damage • Replace the shock absorber as an assembly if necessary. **Skills on diagnosis for Brake system** • Diagnosis for Brake lever/pedal soft or spongy • Diagnosis for Brake lever/pedal hard • Diagnosis for Brake drags **Skills on service of Brake system** • Perform brake fluid filling and Air bleeding. • Carryout removal, inspection and installation front brake pad and rear brake pad.	

		• Visually inspect the brake discs for damage or crack. • Measure the brake disc according to brake system specification and replace if necessary. • Perform removal, inspection & installation of Front and rear Master cylinder. • Inspect the following parts for scoring, scratches, deterioration or damage. - master cylinder - master piston - piston cups • Carryout removal, inspection and installation of Front and rear Brake calliper • Inspect the following parts for scoring, scratches or damage. - calliper cylinders - calliper pistons • Perform removal, inspection and installation of Brake pedal.	
275-320	Plan and organize to find the faults and Diagnosis of vehicle electrical and electronics and suggest appropriate measure for its functionality.	**Skills on diagnosis for Battery** • Battery is damaged or weak. **Skills on service of Battery** • Perform removal, inspection and installation of Battery. • Measure the battery voltage. • Carryout current Leakage test. • Carryout removal and installation of Regulator/Rectifier system. • Inspect Regulator/Rectifier system. **Skillson Electrical Lighting system** • Replace head light bulb. • Replace turn signal light bulb. • Replace brake and tail light	**Diagnosis for Battery** • Causes and remedy for Battery trouble **Service of Battery** • Importance of Charging system and its components **Electrical Lighting system** • Read circuit diagram for different lighting system

		bulb. • Replace license light bulb. • Replace Horn. • Carryout removal and installation of Combination meter. • Carryout removal and installation of fuel level sensor. • Inspect fuel level sensor resistance & Replace the fuel level sensor if it is out of specification. • Carryout removal, inspection and installation of ignition switch. • Replace right and left handlebar switch. • Replace brake light switch. • Inspect turn signal relay.	
	Project Work/ Industrial Visit		
	Revision		

9. SYLLABUS – EMPLOYABILITY SKILL

Learning Outcome	**1. Leadership Skills** **Duration : 20 Hrs.**
1. Exhibit leadership qualities and entrepreneurship skills.	Leadership - Define leadership, types of leadership, leadership Traits, Functions of leadership, styles of leadership. Resolving Individual differences among people.
	Risk Analysis tools; estimate the risks that you could face in your role. In turn, this helps you manage these risks and minimize their impact on your plans. Break-even point analysis. Risk Value = Probability of Event x Cost of Event.
	Success stories / Best Practices – Inspection, inspect Demo displacement. Innovation has become one of the most popular buzz words of the Digital Age. Re-evaluate the true meaning of a concept than when it is being touted by individuals and companies around the world. Spark innovation, maximize productivity, and increase profitability as a result of implementing the Big Five behaviors.
	Stress management - Define Management, Type of stress Management, How to improve stress in workplace, Team leader in workplace.
	Manage relationships with client who may be confused with the services requirements. Build healthy client relationships and use customer centric approach.
	2. Entrepreneurship Skills **Duration : 20 Hrs.**
	Self Employment as a Career path - Define Entrepreneurship, Strategy of entrepreneurship, Market Research. Implementation of self Employment in workplace Ps, Mange self employment in workplace. Quality consciousness – its relevance.
	Study of Competitive Advantage Model. PEST factors for external changes and implement VRIO resources for getting an edge over the competitors.
	Ensure that environmental conditions are suitable for the client and the services to be carried. Deal with clients lacking the technical background to solve the problem on their own.
	Immediate or temporary solutions to resolve delays.
	5 Strategies of handling sensitive issues (political, commercial,

	environmental, cultural, and so on) at workplace – 1. Define the issues, 2. Develop Policies Adhering to Company Goals, 3. Communicate Policies, 4. Hold People Accountable and 5. Continue to Evolve.
	Define marketing; Tools of marketing, 7 Ps define market strategy, important of market strategy, use of strategy in trade theory (Labour Market Information).
	3. Organizational Skills **Duration : 20 Hrs.**
2. Apply organisational principles and practices using creative abilities and digital skills.	Training & Managerial responsibilities Introduction & discussion on managerial responsibilities.
	Basic quality Concept & 5'S Colour Dynamics
	Follow the organisation's policies and procedures for working with colleagues.
	Time management - Workplace time Management, maintain Time management, Benefits of Time Management in workplace, Time management schedule.
	4. Creative Abilities **Duration :20 Hrs.**
	Boosting Morale - Boosting ethics & Development work environment, ethics theory, Development of work environment & training process, knowledge of presentation &self motivation.
	Five Dimensions to conceptualize your idea to make it a successful innovation. When conceptualizing an idea, it is essential to ask questions like what is the problem that the idea solves, who is the consumer for the idea, does the idea solve the consumer's problems and how will the solution be delivered to the consumer. It is very important to direct the thinking to specific dimensions and search answers to certain questions that help in evolving the idea from the initial thought through the various stages of innovation.
	The single most effective way to come up with a business idea is to solve a problem. Next step, you bring the idea to life. Whether it's code, carpentry, or culinary, a project is a created idea. When

	the project is nearly complete and it's time to begin putting the project into the hands of real people. Once your project is perfected through testing, it's time to come up with a way to make money from it. Growth - Get the word out about the thing.
	5. Digital Skills **Duration : 20 Hrs.**
	Write memos and e-mail to customers, co-workers, and vendors to provide them with work updates and to request appropriate information.
	Operate all types of digital tools like laptops, palmtops, mobiles, fax machines, printers, projectors, conferencing tools effectively.
	Attributes that feature in the emergence of novel technologies are: (i) radical novelty, (ii) relatively fast growth, (iii) coherence, (iv) prominent impact, and (v) uncertainty and ambiguity. The framework for operationalising emerging technologies is then elaborated on the basis of the proposed attributes.
	Understanding and adhering to the Information security aspects of the organization based on ISP. Information Security Policy (ISP) is a set of rules enacted by an organization to ensure that all users or networks of the IT structure within the organization's domain abide by the prescriptions regarding the security of data stored digitally within the boundaries the organization stretches its authority.
	Create or convert textual contents into graphical representation, charts, diagrams and flow charts. Learn to make graphs and charts in MS excel. Use of digital camera and other imaging tools. Use of MS-Powerpoint for developing diagrams and flowcharts.
	6. Self-Management **Duration : 20 Hrs.**
3. Organize work efficiently by self-management and effective communication.	Decision making pertaining to the concerned area of work. Decision making process.
	Identifying the strengths - SWOT Analysis. Define SWOT analysis, Important of SWOT analysis, characteristics of SWOT analysis, Example of SWOT analysis related with Trade development in

	detail
	Apply, analyze, and evaluate the information gathered from observation, experience, reasoning, or communication, as a guide to thought and action.
	Use of multi-model strategies of articulation such as audio visual tools, kinaesthetic learning tools, etc.
	7 thoughts on taking responsibility at workplace- 1. There is always a price to pay. 2. Build your self-esteem.3. Give yourself the permission to work as you want.4. Taking actions 5. Understand the limits of your responsibility. 6. Don't forget to take responsibility in everyday work life. 7. Aim to be your best self.
	7. Plan and organize the work related to the occupation **Duration : 20Hrs.**
	Prepare and organize service feedback files/documents.
	The best way is to plan for workplace/ assembly location is to think of any emergency situation before it happens. Think clearly and logically in a crisis, so it is important to do so in advance with due consideration of the operational stipulation.
	Question-answer session to be conducted appropriately in order to understand the nature of the problem and make a diagnosis of the task.
	Guidelines for delegating roles and responsibilities to co-trainees: 1. Identify key opportunities for delegation, 2. Establish a clear set of objectives for each task, 3. Play to your coworker's strengths, 4. Construct a timeline, 5. Use follow-up tasks to keep your workers on point, 6. Establish authority and respect, 7. Use a feedback loop to make future delegation easier.
	8. Effective communication (written and verbal) **Duration : 10 Hrs.**
	Communication process & elements of communication. Maintain clear communication with colleagues (by all means including face-to-face, telephonic as well as written). Pass on information to stakeholders in line with organisational requirements both through verbal as well as non-verbal means. Principles of effective communication, body language, handling

	nervousness/ discomfort and dealing with barriers.
	Different Types of Communication Aids: Projected/ Non Projected using different types of board in a class room session. Black board, White board, Flannel board, Magnetic board etc. Application, use & maintenance of OHP, Digital Camera, LCD projector and Smart board. Preparation of slides in MS-Powerpoint and presentation of the slides. Handle FAQ session during meetings.
	9. Emotional intelligence **Duration : 10 Hrs.**
4. Implement Continuous Professional Development (CPD) using emotional intelligence.	Work with colleagues to integrate work. Work in ways that show respect for colleagues.
	Getting it right from the very beginning, you'll most likely see things flourish. Spending ample time collecting information, allow client to share their knowledge and participate in the project.
	Adopt a flexible attitude, learn about the culture beforehand, expect differences, understand hierarchies, be upfront about difficulties in communication, be respectful & tolerant and be patient.

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT (for batch of 20 Candidates)		
Advanced Diploma (Vocational) in Automotive Technology		
S No.	**Name of the Tools and Equipment with specification**	**Quantity (Nos.)**
A. TRAINEES TOOL KIT per 4 Trainees (FOR 20 TRAINEES +1 INSTRUCTOR)		
1.	Allen Key- set of 12 pieces (2mm to 14mm) Hexagonal key, complete set.	5+1
2.	Adjustable spanner(pipe wrench of 350 mm) nominal size.	5+1
3.	Caliper inside -150 mm Spring type, high grade steel made with Hardened tips	5+1
4.	Calipers outside- 150 mm spring type, high grade steel made With Hardened tips	5+1
5.	Center Punch 10 mm. Dia. x 120 mm. Carbon steel, With 90º point angle	5+1
6.	Dividers- 150 mm Spring type, Mild steel made With Hardened tips	5+1
7.	Electrician Screw Drivermindia of 5 mm and blade length of 250 mm length, the blade of screw driver provided with insulting sleeve.	5+1
8.	Hammer ball peen mass of 500 g with wooden handle of a length of 300 mm	5+1
9.	Hands file 20 cm. Second cut flat	5+1
10.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	5+1
11.	Pliers combination 20 cm.	5+1
12.	Safety glasses	5+1
13.	Screw driver 20cm.X 9mm. Blade	5+1
14.	Screw driver 30 cm. X 9 mm. Blade	5+1
15.	Scriber 15 cm with hardened steel tips	5+1
16.	Spanner D.E. set of 12 pieces (6mm to 32mm)	5+1
17.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	5+1
18.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	5+1
19.	Steel rule 30 cm inch and metric	5+1
20.	Utility KnifeThree position, retractable blade, overall adjustable length 150mm with plastic handle.	5+1
21.	Wire cutter and stripper	5+1
22.	Steel tool box , five section cantilever with lock and key (folding type) 400x200x150 mm	5+1
B. Tools Instruments and General Shop outfits		
23.	Air bag deployment Tool kit suitable for all vehicles	1
24.	AC alternator slip ring puller	1

25.	Adjustable spanner (pipe wrench 350 mm)		2
26.	Air blow gun with standard accessories suitable for Blowing off chips, drying, painting (part cleaning), operating medium through compressed air, with nozzle size of 3 mm.		1
27.	Air impact wrench with standard accessories of Square drive of 1/2", working torque range of forward 70- 380 Nm, in reverse max torque of 620 Nm, Min hose size of 10mm @ 6 bar, Impact wrench of Nominal Size of metric sockets form M6 to M30		4
28.	Air operated oil waste aspirator mounted with 80 litre tank		1
29.	Allen Key- set of 12 pieces (2mm to 14mm) Hexagonal key, complete set.		4
30.	Star Allen Key Set Wrench 9 PCS Silver Tone Metal TORX /Star Allen Key Set with Hole from T10-T50		2
31.	Alternator regulator testerapplicable to different brand of vehicle		1
32.	Ammeter Analog type portable 300 A/60 A DC with external shunt with probe Fitted in Box		4
33.	Angle plate adjustable 250x150x175		1
34.	Anvil 50 Kgs with Stand		1
35.	Battery –charger of Input Volt-230A.C. ,50 Cycle, Current up to 200 Amps, Battery charging requirements in different voltages like 12V, 24V, 48V, 120V DC Output volt-24 D.C.		2
36.	Battery load tester suitable for Variable load capability to 1000 Amps and Tests 2000CCA		1
37.	Battery Terminal puller&battery terminal brush		1
38.	Ball joint end pullerSuitable for on many domestic and import front wheel drive vehicles		1
39.	Belt Tensioner gauge		1
40.	Brake bleeder and vacuum pump kit		1
41.	Brake fluid tester to tests and indicates on LEDs in terms of percent of water in the brake fluid.		1
42.	Caliper inside -15 cm Spring type, high grade steel made With Hardened tips		4
43.	Calipers outside- 15 cm spring type, high grade steel made With Hardened tips		4
44.	Chisel 100 mm flat Octagonal stock, 60 deg cutting angle.		4
45.	Chisels cross cut 200 mm X 6mm Octagonal stock		4
46.	Circlip pliers Expanding and contracting type 15cm and 20cm each	Circlip pliers -External bent size of 150 mm and Internal circlip pliers of size 200 mm each, with hardened tips. (4 in a set)	4
47.	Clamps C- 100mm x 70 With suitable handle		2
48.	Clamps C- 150mm x 80 With suitable handle		2
49.	Clamps C -200mm x 90 With suitable handle		2
50.	Cleaning tray 45x30 cm.		4
51.	Coil spring compressor for suspension spring designed to quickly and easily compress suspension Mac Pherson Strut Springs.		1

52.	Compression and vacuum pump hand operated with suction cup	1
53.	Compression testing gauge suitable for diesel Engine. Gauge should be shock protected, with dual calibration of 0-1000 psi, 0-70 bar, standard glow plug adapter, injector adapter suitable for Maruthi, Tata, Hyundai, Nissan and Ford etc.,	2
54.	Electronic Continuity Tester to determine if an electrical path can be established between two points that is if an electrical circuit can be made	6
55.	Coolant reverse flushing gunSuits most radiator and heater hoses	1
56.	Coolant Flushing Machinepumps that operate on 12 V DC power inputandshould have 2 separate containers for fresh and used coolant	1
57.	Cooling system testerSuitable for the pressure testing of cooling systems and radiator caps up to 35psi with all adapter set	1
58.	Creeper	2
59.	Connecting rod alignment fixture suitable for checking the twist and bend in the connecting rods of all types of reciprocating engines, with precision dial indicators for accuracy.	1
60.	Cylinder bore gauge capacity 20 to 160 mm	4
61.	Cylinder liner- Dry & wet liner, press fit & slide fit liner of any brand of LMV or HMV for demonstration.	1 each
62.	DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms	2
63.	Depth micrometer -0-25mm Analog type, Least count 0.01mm, with all accessories in a box	4
64.	Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand)	4
65.	Demonstration Board of different type of piston supplied of any brand of OEM produce as Dome, Bowl, Flat and Flat Top Piston with Valve Relief.	1set
66.	Dividers- 15 cm Spring type, Mild steel made With Hardened tips	4
67.	Drain plug spannerincludes a magnetic handle to keep steel drain plugs from dropping while removing and with 8 different common drain plug size sockets (13, 14, 15, 6, 17, 18, 19, 24mm) to fit nearly all vehicles.	2
68.	Drift punch copper of nominal size of 150mm	4
69.	Drill Twist -(assorted) (Consumables) HSS made straight shank, 0.5mm step	4
70.	Electric Soldering Iron 230 V 60 watts; 230 V 25 watts	2 each
71.	Electric testing screw driver- With neon bulb indicator, flat tip.	4
72.	Engineer's square of blade length 150 mm, Grade-A and Type 1.that is, with stock	4
73.	Engineers stethoscope	1
74.	Executive Auto Electrical tool kit - Min 8 pcs	1
75.	Feeler gauges of set No. 4 (20 blades) length 100 mm metric	4
76.	File flat 20 cm bastard	4
77.	File, half round 20 cm second cut	4
78.	File, Square 20 cm second cut	4
79.	File, Square 30 cm round	4

80.	File, triangular 15 cm second cut	4
81.	Files assorted sizes and types including safe edge file (20 Nos)	2 set
82.	Flat File 25 cm second cut	4
83.	Flat File 35 cm bastard	4
84.	Flywheel lock toolLocks flywheel in place when removing harmonic balancer	2
85.	Garage stand of Capacity from 3000 kg, Max extendable Height upto 500 mm	4
86.	Gloves for Welding (Leather and Asbestos)	5 sets
87.	Glow plug tester .	2
88.	Granite surface plate 1600 x 1000 with stand and cover	1
89.	Grease gun of lever type with spring-loaded follower and nominal capacity 100 cm3	2
90.	Grease Gun bucket type heavy duty trolley type 10 kg capacity	1
91.	Growler	2
92.	Hacksaw frame adjustable 20-30 cm	10
93.	Hammer Ball Peen 0.75 Kg	4
94.	Hammer Chipping 0.25 Kg	5
95.	Hammer copper 1 Kg with handle	4
96.	Hammer Rubber mallet, of nominal size 400 mm, Type A, having hardness 90 Shore A	4
97.	Hammer PlasticMaterial: Toughened Nylon Hammersize of 45 mm ; 250gm, handle	4
98.	Hammer sludge 10kg	1
99.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2
100.	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 HSS complete set with handle.	1 sets
101.	Hand Shear Universal 250mm	2
102.	Hand Vice - Nominal size of 100 mm	2
103.	Hose clamp remover set able to remove plastic and metal self-tightening hose clamps with diameters of 18 mm to 54 mm	1
104.	Hot Air blow gun, Power input : 1600 w, Working Temperature : 300 - 500 °C Airflow - 240 - 450 l/min	1
105.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
106.	Impact screw Driver - Screw type, Output drive 1/4" , Clutch type Impact (Double Rocking Dog)	2
107.	Injector – Multi hole type, Pintle type	4 each
108.	Insulated Screw driver 20 cm x 9mm blade	4
109.	Insulated Screw driver 30 cm x 9mm blade	4
110.	LED test lamp portable	2
111.	Left cut snips 250mm	4
112.	Magnet pickup with camera	1
113.	Magneto spanner set with 8 spanners	1 set

114.	Magnifying glass 75mm	2
115.	Marking out table 90X60X90 cm.	1
116.	Multimeter digital	5
117.	Multi-point fuel injection pump of any brand of LMV (New) vehicle, full size unit along with the special tool required for Disassembly and reassembly	2
118.	Non contact and contact type tachometer, digital, upto 99,999 RPM range	1
119.	Non contactinfra-red pyrometer -40 dig's to 1000 deg c	1
120.	Oil can 0.5/0.25 liter capacity	4
121.	Oil filter wrenchto Remove all oil filters from 2-1/2 to 4 in diameter. Use with 1/2 square drive tool.	2
122.	Oil pressure testerwithQuick release coupling adapters, Large easy to read dual scale gauge 0 – 150 psi	1
123.	Outside micrometer 0 to 25 mm analog type, 0.01mm least count	4
124.	Outside micrometer 25 to 50 mm, Analog type,Least count 0.01mm	4
125.	Outside micrometer 50 to 75mmAnalogtype,Least count 0.01mm	1
126.	Outside micrometer 75 to 100 mm Analog type,Least count 0.01mm,	1
127.	Fuel Injection Nozzle of Petrol	4
128.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	2
129.	Pipe cutting tool -Roller type with flare cut off groove, fold away reamer and spare cutting wheel under reamer, max size upto 28mm.	2
130.	Pipe flaring tool	2
131.	Piston clearance feeler gaugeSet Includes 25 Blades - 12-Inches Long Designed for Long Reach Applications	1
132.	Piston ring compressor ,Strong Spring Steel, Fits Size: 2-1/8" to 7" (53mm - 175mm)	2
133.	Piston Ring expander and remover having the feature of Anti-corrosive, Sharp edges of sizes of 40-100 mm	2
134.	Piston Ring groove cleaner.	2
135.	Pliers combination 20 cm.	2
136.	Pliers flat nose 15 cm	2
137.	Pliers round nose 15 cm	2
138.	Pliers side cutting 15 cm	2
139.	Pole screw driver unit for starter	
140.	Portable electric drill Machine - Single phase, Max: drill size Dia: 12mm with chuck key, Insulated handles and accessories, with suitable length of electrical wire. Max: speed between 1800 and 2200rpm.	1
141.	Portable hand grinding machineRated power input : 750 W No-load speed :11000rpm	1
142.	Prick Punch 15 cm	4
143.	Punch Letter 4mm (Number)	2 set
144.	Right cut snips 250mm	2
145.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm	2
146.	Scraper flat 25 cm	2

147.	Scraper half round 25 cm	2
148.	Scraper Triangular 25cm	2
149.	Scriber 15 cm	2
150.	Scriber with scribing black universal	2
151.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
152.	Spanner T. flocks made high grade Chrome - Vanadium steel Size (mm) 2-12 mm	2
153.	Spanner, adjustable 15cm.	2
154.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	4
155.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	2
156.	Spark lighter- For igniting gas welding torch	2
157.	Spring tension gauge 0-4.5 kg	1
158.	Spark plug spanner 10mm, 14mm, 18mmSize	2 no each
159.	Steel measuring tape -10 meter in a case Steel engraved	4
160.	Steel rule -15 cm, inch and metric Stainless Steel made with Engraved readings.	4
161.	Steel rule -30 cm, inch and metric Stainless Steel made with Engraved readings.	4
162.	Straight edge of Hardened steel, Finished & ground on both sides and edges of size 600 mm.	2
163.	Straight edge of Hardened steel, Finished & ground on both sides and edges of size 1500 mm	2
164.	Stud Extractor Sets6 Piece Sizes: No. 1, 2, 3, 4, 5 and 6.	2 sets
165.	Stud remover with socket handle6; 8; 10; 12 mm with socket	1
166.	Surface gauge with dial test indicator plunger type i.e. 0.01 mm and magnetic base	4
167.	Taps and Dies complete sets BSF, BSW	1 set
168.	Taps and wrenches – metric complete set up to M12 with die stock	2 sets
169.	Telescope gauge	4
170.	Telescopic Transmission Jack 1/2 ton	1
171.	Electric Digital Water Temperature Gauge Sensor Motor Car Thermometer 0-100 deg c	2
172.	Tester sparking plug 'NEON' Type	1
173.	Thermometer 0-200 range	2
174.	Thread pitch gauge metric, BSW , BSF	2
175.	Timing lighter	2
176.	Toe-in, toe-out gauge	1set
177.	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
178.	Torx screw driver set	2set
179.	Tread wear indicator	2

180.	Tube valve key inserter	2
181.	Tubeless tyre repair kit	
182.	Tyre pressure gauge with holding nipple	2
183.	Universal puller for removing pulleys, bearings	1
184.	'V' Block having a feature of precise V -shaped groove cast iron material of size 75 x 38 x 38 mm pair with clamps	2
185.	Vacuum gauge to read 0 to 760 mm of Hg.	2
186.	3mm to 13mm, 4 Piece Small Hole Gage Set	4
187.	Universal valve guide remover, Mechanical type	2
188.	C Type Valve Lifter	1
189.	Valve spring compressor universal.	1
190.	Vernier Caliper, Measures both in mm & inches, Hardened stainless steel construction, Least Count: 0.02 mm, 0.001" ; Range 0-153mm (0-6")	4
191.	A vice grip plier, Type 2 (curved jaw), Nominal size 250 mm.	2
192.	Volt meter 50V/DC	6
193.	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw with steel structure	4
194.	Vacuum Cleaner – Wet and Dry type	1
195.	Wheel choke	4
196.	Wheel Spanner	4
197.	Wire Gauge (metric)	2
198.	4 Point relays, 12V	2
199.	5 Point relays, 12V	2
C. General Installation/ Machineries		
200.	AC Gas Leak Electronic detector & UV Leak detector for CFC, HFC refrigerants	1
201.	ABS (Antilock brake systemTrainer)trainerisabletodemonstrateABShydraulicandelectricalsystemoperation, aswellasprovidetheabilitytosimulatechangesinroadconditionsthatimpactABSoperation, ESP functions and fault simulation board	1
202.	Working model of Air Brake Assembly model using actual components and motorized to show operation	1
203.	Air bag simulator working model	1
204.	Air conditioned CRDI Vehicle in running condition -LMV	3
205.	Air conditioned MPFI Vehicle in running condition -LMV	3
206.	Alternator assembly of any brand of LMV/HMV 12 Volt 40 amp along with special tools if any for Disassembly and reassembly	2 each
207.	Hand operated Arbor presses is ideally utilized for inserting and removing bushes, bearing and allied purposes. Capacity- 2 Ton, Heavy cast Iron Body	1
208.	Anti theft device demonstration board shows the car safety devices operation	1
209.	Auto Electrical test bench able to test alternator, starter and vacuum pump.	1

	Electrically and battery operated. Able to test alternator with different loads	
210.	Nitrogen Tyre Inflator	1
211.	Automatic sequential six gear transmission gear box any brand of car for fitted with frame along with special tools.	1
212.	Auto transmission trainer is equipped with a four speed automatic transmission and consists of the control unit and a gear substitute panel. The sensor /Actuator signal connections are reliably run to the back.	1
213.	Automatic Tire Changer Machine	1
214.	Automotive exhaust 5 gas analyzer& Diesel Smoke Meter	1
215.	Bench lever shears 250mm Blade x 3mm Capacity	1
216.	Car test lane with roller brake tester, suspension tester, side slip tester, head light tester	1
217.	Chain Pulley Block-3 ton capacity with tripod stand(Engine Crane)	1
218.	Constant Mesh Gear box with stand and CVT Gear box with stand for Dismantling and assembly.	1 each
219.	Mock layout of a motor car –electrical system working model.	1
220.	Cut section working model of automatic transmission Gear box (DSG)	1
221.	Cut section working model of centrifugal clutch assembly.	1
222.	Cut section working model of Diaphragm clutch assembly.	1
223.	Cut section working model of Single plate clutch assembly.	1
224.	Cut section models of shock absorber	1
225.	Cut section of cross ply and radial tyre	1
226.	Computer for Autotronicsi7 configuration	10
227.	Demonstration Board (made of acrylic or wood) of Ignition System for automobile 4 wheelers made out of 1) Switches 2) Ignition coil 3) Distributor 4) Four spark plugs 5)Battery for power source and necessary wiring connections having the feature of start functioning by putting on the switch as well as by rotating the distributor. Further, sequential sparks in the spark plugs can be demonstrated in these boards.	1
228.	Demonstration Board of MPFI System Working Model which is made out of original used parts such as petrol injector, inlet manifolds, throttle body, distributor, ECU, canister purge valve, carbon canister, fuel tank module, supporting sensors such as lambda sensor, engine speed sensor, cam position sensor etc. MPFI working system can be demonstrated by with aid of battery.	1
229.	AC Service Machine (car) suitable for servicing of Ac unit of a car system for Recovery, Vacuum, Recharging, Recycle of refrigerant R 134 A with Auto and Manual Mode.	1
230.	Diesel Engine – CRDI - 4 stroke Engine with swiveling stand along with special	3 (1each)

	tools for Dismantling and assembling – 4 cylinder, 6 cylinder, V6 cylinder	
231.	Diesel engine (Running condition) Stationary type with all accessories like cooling, lubrication, fuel systems and electronics , turbo charger	1
232.	Discrete Component Trainer / Basic Electronics Trainer	1
233.	Disk brake with caliper assembly working model	1
234.	Drilling machine bench to drill up to 12mm dia along with accessories	1
235.	Driving Simulator	1
236.	Distributor –Duel advance type, reluctance type	2 (1 each)
237.	Drum brake assembly of any HMV	1
238.	Front axle drive with transfer case gearbox, RzeeppaUV Joint fitted with stand for Dismantling and assembly	1
239.	Educational Software's for E- Learning Automotive subject	4 license
240.	Full floating axle, semi floating and three Quarter floating axle fitted in a stand for dismantling and assembly	3 (1 each)
241.	Four stroke petrol engine with CNG setup-working condition	1
242.	Functional working model of clutches –coil spring and diaphragm type.	1Each
243.	Functional/experiment model of different type of sensors.	1
244.	D.E. Pedestal Grinding machine with 300mm diameter wheels rough and smooth with twist drill grinding attachment. Motor 1HP 1Phase, 230V 50Hz.	1
245.	Hand operated Hydraulic press 5ton capacity.	1
246.	Hydraulic jack HI-LIFT type -3 ton capacity, and 5 Ton capacity	1each
247.	Hydraulic trolley jack 5 ton capacity	1
248.	Injector testing set (Hand tester) for diesel injectors	1
249.	Lifting jack screw type 3 ton, 5ton & 20 Ton capacity	1 each
250.	MPFI petrol engine with swiveling stand along with special tools for dismantling and assembling- 4 cylinder, 6 cylinder and v6 cylinder	3 (1 each)
251.	Multi Scan Tool with oscilloscope	1
252.	Oscilloscope 60MHz	1
253.	Radiator cut section-cross flow	1
254.	Radiator cut section-down flow	1
255.	Pneumatic rivet gun with standard accessories	2
256.	Semi-automatic hydraulic car wash system (under chassis automatic car wash system)	1
257.	Spring tension tester	1
258.	Starter motor axial type, pre-engagement type & co-axial type for testing and dismantling and Assembly	1 each
259.	Steering assembly - 1.Rack& pinion, 2.Worm & roller 3. Recirculating ball, 4.Power steering	1 each
260.	Synchronous Gear box with stand for Dismantling and assembly.	1
261.	Tin smiths bench folder 600 x 1.6mm	1

262.	Transfer case with stand for Dismantling and assembly.	1
263.	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
264.	Tube/ tyre vulcanizing machine semi automatic	1
265.	Turbocharger cut sectional view on stand	1
266.	Two post car lift – capacity 4000 kg	1
267.	Ultrasonic Injection cleaning equipment	1
268.	Vacuum assisted hydraulics brake assembly with vacuum booster working model	1
269.	Vehicle Mutiplex network trainer –CAN BUS, LIN BUS,& MOST BUS trainer along with accessories & Analysis software	1
270.	Wiper motor assembly	1
271.	Working Model of power windows	1
272.	Working model of torque converter	1
273.	Welding plant Oxy-Acetylene complete (high pressure)	1
274.	Welding Transformer (150-300 Amps)	1
275.	Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board	1
276.	Working Condition of Petrol MPFI Engine Assembly with fault simulation board	1
277.	Wheel alignment Machine –computerised 3D with four post lift	1
278.	Wheel balancing machine	1
279.	Engine Dynamometer	1
D. List of consumable:		
280.	Automatic Transmission oils	As required
281.	Battery- SMF	As required
282.	Brake fluids	As required
283.	Chalk, Prussian blue.	As required
284.	Chemical compound for fasteners	As required
285.	Diesel	As required
286.	Different type gasket material	As required
287.	Different type of oil seal	As required
288.	Drill Twist (assorted)	As required
289.	Emery paper - 36–60 grit, 80–120	As required
290.	Engine coolant	As required
291.	Engine oil	As required
292.	Gear oils	As required
293.	Gloves for Welding (Leather and Asbestos)	5 sets
294.	Hacksaw blade (consumable)	As required
295.	Hand rubber gloves tested for 5000 V	5 pair
296.	Holders, lamp teakwood boards, plug sockets, solders, flux wires and cables	As required

	batteries round consumable blocks and other consumables as required	
297.	Hydrometer	4
298.	Lapping abrasives	As required
299.	Leather Apron	5
300.	Petrol	As required
301.	Power steering oil	As required
302.	Radiator Coolants	As required
303.	Safety goggles	As required
304.	Steel wire Brush 50mmx150mm	5
305.	Electronic component such as Diodes, transistors, capacitors, resistors, relays, solenoids, ICs, PCB, Breadboards, SCR, potentiometers as required	As required
306.	AC gas	As required

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor:													**Year of Enrollment:**		
Name & Address of Institution:													**Date of Assessment:**		
Name & Address of the Industry:													**Assessment location: Industry / Institute**		
Trade Name:			**Examination:**										**Duration of the Trade/course:**		
Learning Outcome:															
S No.	**Maximum Marks (Total 100 Marks)**		**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**	**Total Internal Assessment Marks**	**Result (Y/N)**
	Candidate Name	**Father's /Mother's Name**	Usage of PPE	Workplace Hygiene	Punctuality& Discipline	Ability to Read & Interpret Manuals/ Catalogues/Datasheets	Application of Knowledge& Skills	Ability to work in team and leadership skills	Communication and Interpersonal Skills	Attitude towards work	Quality in Workmanship	VIVA		
1														
2														