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

COMPETENCY BASED CURRICULUM

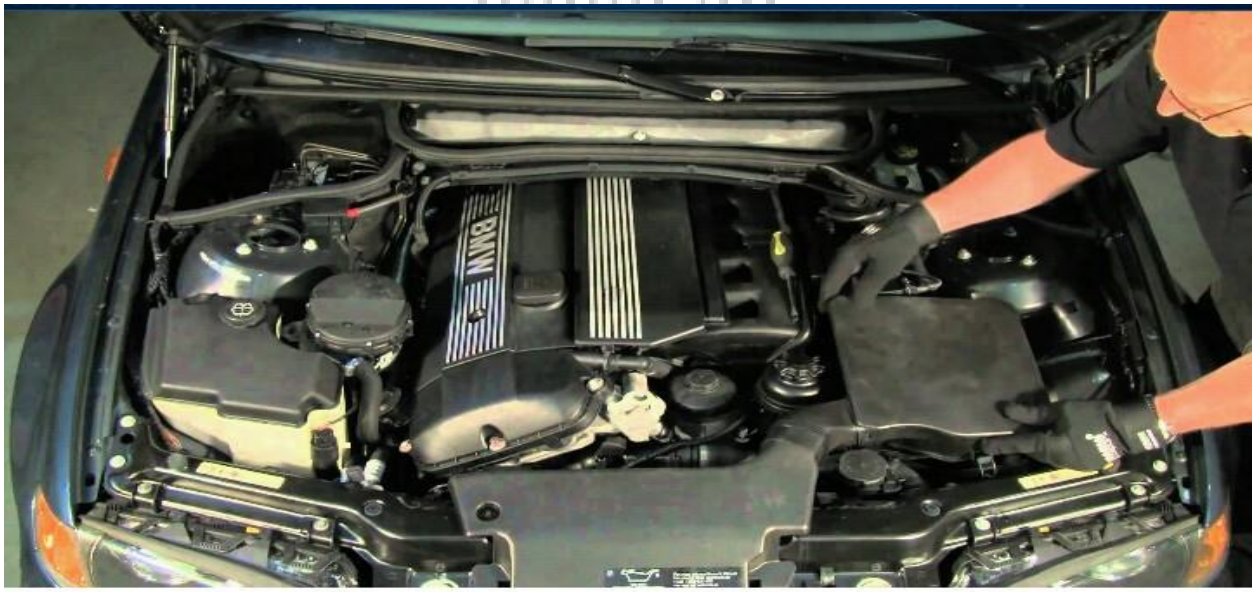
AUTOMOTIVE SERVICE & REPAIR

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL- 5



SECTOR – AUTOMOTIVE

Directorate General of Training

Skill India
कौशल भारत - कुशल भारत

AUTOMOTIVE SERVICE & REPAIR

(Engineering Trade)

(Revised in 2018)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

Flexi- MoU is one of the pioneer programmes under NCVET on the basis of the MoU in between DGET &Maruti Suzuki India Limited for propagating vocational training to allow industries to take advantage of various schemes for conducting training programme in higher employment potential courses according to needs of industries. The concept of Flexi- MoUs was introduced in June-July 2014. DGT and Maruti Suzuki India Limited have decided to sign this memorandum of understanding to provide an opportunity to the youth to acquire skills related to Automobile and Manufacturing industry through specially designed "Learn and Earn" approach consisting a mix of theoretical and On-the-Job Training (OJT) components and hence improve their employability potential& to contribute in the overall growth of Automobile and manufacturing industry by creating a pool of skilled resources.

During the two-year duration, a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. In addition to this, a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task.

The content broadly covers skills in service & repair process of 4-wheel automobiles in auto dealer service workshops. The year wise course coverage is categorized as below:

FIRST YEAR – In the first year the contents covered from safety aspect related to trade, knowledge of automobile industry, familiarization with automobile systems & components, theory & practical knowledge required for maintenance of 2-stroke & 4-stroke SI & CI engines, compression ratio, stoichiometric ratio, vehicle assembly process through plant visit, engine series & their identification numbers of vehicle, vehicle driving, automobile service & maintenance schedule, tools & equipment used in vehicle maintenance, vehicle washing & cleaning, vehicle service process, emission checking & testing, and ignition timing checking & adjustment. This year's syllabus also covers theory & practical knowledge required for maintenance of wheel alignment, steering system, brake system, transmission system, suspension system, head light beam adjustment, different types of belts in vehicle, under bonnet components, battery function & testing, engine vacuum, compression pressure, engine oil pressure & specifications, electricity, electrical circuits, symbols & wiring diagram, multi-meter, and starting systems of vehicle.

SECOND YEAR – In this year the job covers classification of engines, comparison between petrol & diesel engine, VVT system, emission standards, and valve clearance adjustment, theory & practical knowledge of Petrol engine, intake & exhaust systems, gasoline fuel characteristics, fuel supply system, electronic fuel injection (EFI), EFI engine management, EFI sensors & their working. This year course also covers theory & practical knowledge of diesel engine, valves & valve trains, diesel fuel system, electronic diesel control, common rail diesel injection (crdi), hydraulically actuated electronically controlled unit injector (heui), sensors & actuators and their functioning, and engine immobilizer system. Final part of this year covers different faults occurs in diesel & petrol vehicles, the electrical & mechanical causes of such faults, and troubleshooting of all types faults.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. DGET is futuristic in preparing the prospective Indian workforce in building skills and capabilities as per the needs of the industry. In this quest, it has changed the paradigm of growth to a job oriented growth by partnering with industry to be an enabler of responsible, sustainable and inclusive growth. Towards this end, DGET signed this MOU with the Maruti Suzuki India Limited.

Maruti Suzuki India Limited shall conduct courses pan-India locations leveraging the facilities and services available at ITIs, regional training centers, training centers of training partners, vendors and dealers associated with Maruti Suzuki. Maruti Suzuki will ensure that not less than 50% of trainees are placed with Maruti Suzuki or its business partners for not less than six month duration. It will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams and shall also guide the students to become Entrepreneurs. Maruti Suzuki India Limited will strictly follow the policy guidelines for Flexi - MoU as in place from time to time. No deviation for the same would be permitted. Every Alternate Month Admission and Exam for trades run under Flexi MoU at training locations of Maruti. Theory content to be 30% and practical content to be 70%.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the repair and maintenance work.
- Check the task/job for functioning, identify and rectify errors in task/job.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS

- Can join as skilled worker in the industry and can become supervisor after doing part-time diploma in relevant branch of Engineering
- Can take admission in diploma course in notified branches of Engineering by lateral entry.

- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE

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

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	2944
2	Professional Knowledge (Trade Theory)	552
3	Workshop Calculation & Science	160
4	Engineering Drawing	160
5	Employability Skills	240
6	Revision & Project work	92
7	Examination	252
	Total	**4400**

2.4 ASSESSMENT & CERTIFICATION

I. Conducting training of selected candidates is the sole responsibility of ITP.
II. Assessment will be jointly done by ITP and DGT. Practical and formative assessment shall be conducted by ITP, and Computer Based theoretical exams shall be conducted by DGT.
III. ITP must refer to the latest examination reform guidelines issued by DGT dated 4thOctober 2018 any changes or revisions to the same shall be applicable to flexi-MoU scheme.
IV. Maximum attempts for clearing the exam and obtaining NTC shall be in line with CTS.
V. For practical examination and formative assessment, ITP has been given flexibility to design the questions, assess the candidates and upload their marks in the scheme portal.
VI. ITP shall develop a comprehensive Question Bank (in English and Hindi) of minimum 1000 questions, grouped by chapters and difficulty level. The same shall be vetted by NIMI experts and then be handed over to DGT for conducting theory exams. DGT may add some questions to the same before conducting actual exams.

VII. Theoretical exams shall be conducted by DGT in Computer Based Test format. Upon completion of course and payment of requisite examination fee by ITP, admit cards shall be generated by scheme portal.

VIII. DGT shall arrange for conduct of computer based theory exam at designated examination centres & certify the successful trainees with e-NTC under flexi-MoU scheme with mention of ITP name in the Certificate.

IX. Students, who have successfully appeared in the final exam after completion of course, are eligible to register as apprentices.

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first year itself.

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 has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure –II).

The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 40%. For the purposes of determining the overall result, 25% weightage is applied to the result of each year examination.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising 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 of internal assessments are to be preserved until forthcoming yearly examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, power tools and workshop equipment. • Below 70% of 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 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, power tools and workshop equipment. • 70-80% of accuracy achieved while undertaking different repair / maintenance 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 more than 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, power tools and workshop equipment. • Above 80% of 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

Master Auto Service Technician/Auto Service Technician; An Auto Service Technician Level 5 is responsible for managing range of diagnosis and repairs with a wide range of specialized repair of mechanical, electrical and electronic faults.

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

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

AC Specialist; AC Specialist is responsible for installing, servicing and repairing an air conditioning system of a vehicle. The individual also performs routine maintenance of the various components associated with the air-conditioning system of the vehicle.

Auto Service Technician – Mechanic; Auto Service Technician Level 4 is responsible for the repair and routine servicing and maintenance (including electrical and mechanical aggregates) of vehicles.

Test Technician; Test Technician is responsible for conducting various types of tests inside the laboratory as well as supporting on road testing. The role holder is responsible for setting the test apparatus on the test bench, connecting the aggregates/vehicle under test to the test bench, support the engineer in taking readings during tests procedures, making minor modifications to the test setup and keeping the test areas and apparatus in a clean and working condition.

Fitter Automobile; Fitter, Automobile attends to minor repairs to motor vehicles under guidance of Mechanic Automobile. Receives instructions from Mechanic, Automobile about

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

In summary an 'Automotive Service & Repair' Technician will be able to explain & comply with Health Safety & Environment procedures, independently identify faults of four wheel automobiles and perform service & repair jobs of vehicles as per defined procedure utilizing all tools & equipment available in an automobile service & repair workshop.

Reference NCO-2015:

a) 3115.0601: Master Auto Service Technician/AutoService Technician,
b) 7231.0100: Mechanic, Automobile
c) 7231.0101: Maintenance Technician – Service Workshop
d) 7231.0102: AC Specialist
e) 7231.0107: Auto Service Technician – Mechanic
f) 7231.0201: Test Technician
g) 7231.0400: Fitter Automobile

4. GENERAL INFORMATION

Name of the Trade	**Automotive Service & Repair (Flexi MoU)**
NCO - 2015	3115.0601, 7231.0100 , 7231.0101, 7231.0102, 7231.0107, 7231.0201, 7231.0400
NSQF Level	Level – 5
Duration of Craftsmen Training	Two years
Entry Qualification	Passed 10th Class or its equivalent
Unit Strength (No. Of Student)	20
Space Norms	192 Sq. m.
Power Norms	17 KW
Instructors Qualification for	
1. Automotive Service & Repair Trade	Degree in Mechanical Engineering or Automobile Engineering from recognized Engineering College /university with one year experience in the relevant field. OR Diploma in Mechanical Engineering or Automobile Engineering from recognized board of technical education with two years' experience in the relevant field. OR NTC/NAC in the Trade of "Automotive Service & Repair" with 3 years post-qualification experience in the relevant field. **Desirable: -** Preference will be given to a candidate with CIC(Craft Instructor Certificate) in Motor Mechanic trade. ***Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	Degree in Engineering with one year experience. OR Diploma in Engineering with two years' experience. Desirable: Craft Instructor Certificate in Motor Mechanic course under NCVT.

3. Engineering Drawing	Degree in Engineering with one year experience. OR Diploma in Engineering with two years' experience. OR NTC / NAC in the Draughtsman (Mechanical) with three years' experience. **Desirable:** Craft Instructor Certificate in Motor Mechanic course under NCVT.
4. Employability Skill	MBA OR BBA with two years' experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years' experience OR Graduate/ Diploma with Two years' experience and trained in Employability Skills from DGT institutes. AND Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above. OR **Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes.**
List of Tools and Equipment	As per Annexure – I

Distribution of training on Hourly basis: (Indicative only)

Year	Total Hours/Week	Trade Practical	Trade Theory	Workshop Cal. &Sc.	Engineering Drawing	Employability Skills
1st	48 Hours	32 Hours	8 Hours	2 Hours	2 Hours	4 Hours
2nd	48 Hours	32 Hours	10 Hours	2 Hours	2 Hours	2 Hours

5. NSQF LEVEL COMPLIANCE

NSQF level for **Automotive Service & Repair (Flexi MoU)** trade under CTS: **Level 5.**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. Professional Knowledge
c. Professional Skill
d. Core Skill
e. Responsibility

The broad learning outcome of **Automotive Service & Repair (Flexi MoU)** trade under CTS mostly matches with the Level descriptor at Level- 5.

The NSQF Level-5 descriptor is given below:

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

6. 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 GENERIC LEARNING OUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

FIRST YEAR

9. Recognize & comply safe working practices, environment regulation and housekeeping in an automobile workshop.
10. Explain about the automobile industry in India. Recognise different types of vehicles, vehicle Id. Nos. (VIN) of different components of vehicles, 2-stroke & 4-stroke etc. Perform greasing, spark plug cleaning & changing, valve clearance checking, emission test, vacuum test, compression test & engine oil pressure test.
11. Plan & organize work to illustrate Vehicle Manufacturing process and perform fabrication, welding, blanking, stamping, casting, forging, and machining, painting and assembly process.

12. Illustrate Engine Classification and recognize types of engines.
13. Explain traffic rules & regulations and safety sign and perform Vehicle Driving and obtain driving license.
14. Explain, perform & maintain hand & power tools and operate equipment used in a vehicle repair workshop. Develop skills of machine setting and use of correct tools for fitting of different type of fasteners.
15. Illustrate vehicle maintenance schedules and its importance and list the requirements for different types of service to vehicle.
16. Explain and perform Vehicle washing and cleaning.
17. Plan & organise to explain the details of vehicle service, requirement of tools, equipment, consumables, and components for the job and perform Vehicle Service Process.
18. Prepare all the necessary tools and equipment and perform Wheel balancing and alignment of vehicle
19. Plan & organise to check the faults, explain the causes and perform repairing & servicing of Steering System defects.
20. Illustrate the brake system and defects in a vehicle brake system and perform repairing, servicing, parts replacement, and adjustment of Brake system.
21. Explain importance & process and perform Transmission Oil replacement.
22. Recognise different types of engine belts, Define their importance. Perform inspection of belt faults and perform adjustment and replacement of engine belts.
23. Define Suspension system and components. Conduct inspection for wear & tear.
24. Explain Head Lights & its construction. Perform Headlight beam adjustment.
25. Recognise & explain all the components of vehicle fitted under bonnet and Under Body. Perform dismantling and assembling under bonnet and under body components.
26. Illustrate Engine testing parameters and perform Engine Vacuum Test, Compression Pressure Test, and Engine Oil Pressure Test of different Engines.
27. Remove Battery from vehicle, inspect for defects and deficiencies, top-up electrolyte, perform battery tests, and re-fit after servicing / cleaning.
28. Explain Automobile Electricals. Check wiring with the help of wiring diagrams, and perform various electrical testing & inspection. Conduct Battery Function Test and charging.

SECOND YEAR

29. Recognise different types of engines and illustrate the difference between Petrol & Diesel engine. Describe VVT system and its function.

30. Illustrate Petrol engine and components. Test perol engine and take readings of various instruments fitted in vehicle. Perform dismantling of engine, inspecting the condition of components and assembling the engine.
31. Plan & organise work to clean the fuel tank, inspect for leakage & condition. Explain the Multi Point Fuel Injection (mpfi) system and components of mpfi system. Perform the testing of mpfi system components and replace any defective part. Check the functionality of fuel system.
32. Illustrate the EFI engine management, Electronic Control Unit (ECU), Sensors & mountings, and instruments & gauges on dash board. Perform setting-up ECU and testing ECU circuit, testing of all sensors, and replacing of defective sensors.
33. Illustrate Diesel engine and components. Test diesel engine for compression and lube oil pressure and take readings of various instruments fitted in vehicle. Perform dismantling of engine, inspecting the condition of components, lubricating & servicing of components and assembling the engine.
34. Describe Diesel fuel system, components, functioning and possible faults occurs in diesel fuel system. Perform service & repair diesel fuel system.
35. Explain engine faults, mechanical & electrical causes for different types of faults. Identify faults and perform Troubleshooting on engines.
36. Describe chassis of vehicle and its components. Select appropriate tools and perform dismantling and assembling of chassis components.
37. Explain Clutch system, components and function of each component. Perform removal of clutch from vehicle, inspection for faults, repairing of defects or replacement of clutch, re-fitting the clutch and adjustment of clutch play.
38. Describe Gear box of an automobile, components and functioning of gear box & components. Perform removal of gear box from vehicle, dismantling the gear box, inspection of components for wear & tear, rectification of defects, reassembling, filling lube oil, and aligning of gear selector fork. Perform removal, servicing and re-assembling of CV joint. Check Gear box for functionality.
39. Illustrate Rear axle, types of rear axle, components, construction and functions. Perform service & repair of Rear axle.
40. Plan & organise work to check & correct Steering system geometry. Perform removal, service & repairing of faults, repair electronic and hydraulic power system faults of steering wheels, and re-fitting of steering system on vehicle. Carry out steering system play and backlash adjustment after fitting.
41. Illustrate different types of suspension systems. Conduct inspection and perform overhauling of suspension system by removing front & rear suspension system components, check for the condition, replace or repair the faults, lubricating joints, and re-fitting of suspension system. Conduct Road-test with expert team members to identify NVH problems and perform troubleshooting of NVH problems.

42. Plan & organise to identify faults related to Wheel balancing & alignment in a vehicle and perform wheel balancing and alignment.
43. Plan & organise work to explain vehicle Heating Ventilation Air-Conditioning (HVAC) system, components & functioning and perform service & repair of HVAC system faults.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
1. Recognize & comply with safe working practices, environment regulation 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 site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store/ dispose of dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ competent authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
	1.12 Identify environmental pollution and contribute to avoidance of same.
	1.13 Take opportunities to use energy and materials in an environmentally friendly manner.
	1.14 Avoid waste and dispose waste as per procedure.
	1.15 Recognize different components of 5S and apply the same in the working environment.

2. Explain different mathematical calculation & science in the field of study including basic electrical and apply in day-to-day work.*[Different mathematical calculation & science-Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, center of gravity, friction.
	2.2 Measure dimensions as per drawing.
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply with given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material]*	3.1 Read & interpret the information on drawings and apply in executing practical work.
	3.2 Read & analyse the specification to ascertain the material requirement, tools, and machining/assembly/maintenance parameters.
	3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometres, vernier callipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse with the given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards

day-to-day work to improve productivity & quality.	such laws.
	5.3 Knows benefits guaranteed under various acts.
6. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, and pollution and utilize the available resources optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.	7.1 Explain personnel finance and entrepreneurship.
	7.2 Explain role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the Policies/Programmes, procedure and the available scheme.
	7.3 Prepare project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8.1 Use documents, drawings and recognize hazards in the work site.
	8.2 Plan workplace/ workshop location with due consideration to operational stipulation.
	8.3 Communicate effectively with others and plan project tasks.
	8.4 Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.

SPECIFIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
FIRST YEAR	
9 Recognize & comply safe working practices, environment regulation and housekeeping in an automobile workshop.	9. 1 Importance of trade training, List of tools & Machinery used in the trade.
	9. 2 Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE).
	9. 3 First Aid Method and basic training.
	9. 4 Safe disposal of waste materials like cotton waste, waste oil and battery etc.
	9. 5 Hazard identification and avoidance.
	9. 6 Safety signs for Danger, Warning, caution & personal safety message
	9. 7 Preventive measures for electrical accidents & steps to be taken in such accidents.
	9. 8 Use of Fire extinguishers.
	9. 9 Practice and understand precautions to be followed while working in fitting jobs
	9. 10 Safe use of tools and equipment's used in the trade.
10 Explain about the automobile industry in India. Recognise different types of vehicles, vehicle Id. Nos. (VIN) of different components of vehicles, 2-stroke & 4-stroke etc. Perform greasing, spark plug cleaning & changing, valve clearance checking, emission test, vacuum test, compression test & engine oil pressure test.	10. 1 Recognise of different types of Vehicles.
	10. 2 Recognise different types of engine components.
	10. 3 Replace– air cleaner, oil filter & fuel filter.
	10. 4 Apply Grease to parts /through greasing points (if necessary).
	10. 5 Check Spark plug and inspect H.T. cables connected to Plugs.
	10. 6 Clean, Check and Adjust sparkplug.
	10. 7 Ignition Timing checking on Petrol vehicle with timing light & ignition timing adjustment.
	10. 8 Checking of valve clearance and adjusting valve Tappet Clearance according to the Manufacturers Specification.
	10. 9 Emission Testing on petrol & diesel vehicles with the help of exhaust gas analyser.
	10. 10 Engine Vacuum Test, Compression Pressure Test, Engine Oil Pressure Test.

11 Plan & organize work to illustrate Vehicle Manufacturing process and perform fabrication, welding, blanking, stamping, casting, forging, and machining, painting and assembly process.	11.1 Brief Vehicle manufacturing process.
	11.2 Plant visit to vehicle manufacturing industry in following departments; • Fabrication & welding shop manufacturing frames & body shell • Press shop making body shell • Casting shop making Engine block, Engine head • Forging shop making Crank shaft, Cam shaft and gears • Machine shop (CNCs) • Painting shop • Assembly lines assembling different components to produce a car (Trim line, Chassis assembly line, Final assembly line) • Finishing shop conducting final inspection & testing of car
12 Illustrate Engine Classification and recognize types of engines.	12.1 Recognize Engine series.
	12.2 Recognise Engine types with respect to; ii) Type of fuel iii) Cycle of operation iv) Number of strokes per cycle v) Type of ignition vi) Number of cylinders vii) Arrangement of cylinders viii) Valve arrangement ix) Type of cooling
13 Explain traffic rules & regulations and safety sign and perform Vehicle Driving and obtain driving license.	13.1 Four wheel vehicle driving lessons theory.
	13.2 Identify Traffic sign and traffic rules.
	13.3 Learning license test.
	13.4 Permanent driving license test.
14 Explain, perform & maintain hand & power tools and operate equipment used in a vehicle repair workshop. Develop skills of machine setting and use of correct	14.1 Working with tools used in vehicle assembly.
	14.2 Working with pneumatic tools.
	14.3 Use of Vernier calliper, Micrometre and height gauge.
	14.4 Working with hand drill, hammer punches and chisel.
	14.5 Working with drill, reamer and tap.
	14.6 Working with wrench screwdriver and pliers, and Allen keys.
	14.7 Understanding of types and sizes of fasteners and picking of

	tools for different type of fasteners.		defined number of fasteners.
		14.8	Gap setting and checking with feeler Gauge.
		14.9	Operating of spot welding guns and other welding machines.
15	Illustrate vehicle maintenance schedules and its importance and list the requirements for different types of service to vehicle.	15.1	Identify type of service to be provided to different vehicles at service centre from Vehicle maintenance schedule.
		15.2	List all the requirements for different type of service to vehicle depending upon duration or running km.
16	Explain and perform Vehicle washing and cleaning.	16.1	Procedure to clean the vehicle.
		16.2	Steps to be followed for cleaning the vehicle before and after the service.
17	Plan & organise to explain the details of vehicle service, requirement of tools, equipment, consumables, and components for the job and perform Vehicle Service Process.	17.1	Personal Vehicle Safety procedure.
		17.2	PDI & Periodic Maintenance.
		17.3	Vehicle Service Schedule of various MSIL models.
		17.4	Air Filter - Working.
		17.5	Fuel Filter - Working.
		17.6	Engine Lubrication System.
		17.7	Spark Plug - Function, Type of spark plugs.
		17.8	Engine cooling system – working and parts of cooling system.
		17.9	Valve Clearance adjustment Valve clearance Checking process, Tappet adjustment on engine.
		17.10	Understand & explain Valve clearance checking process & perform Tappet adjustment as specified.
		17.11	Emission control and standard.
		17.12	Ignition timing adjustment and inspection.
18	Prepare all the necessary tools and equipment and perform Wheel balancing and alignment of vehicle.	18.1	Check tires, wheel bearings, ball joints, control arms bushings, shock absorbers, struts & power steering.
		18.2	Identify components, brief working principle & operation of computerized, wheel balancing machine and wheel aligner and procedure for taking readings.
		18.3	Perform wheel balancing and wheel alignment of vehicles, take a print out.
		18.4	Tests drive the vehicle to confirm the repairs.
19	Plan & organise to check	19.1	Check and correct the steering geometry with instruments.

	the faults, explain the causes and perform repairing & servicing of Steering System defects.	19.2 Remove and refit steering boxes from vehicle.
		19.3 Check and top-up oil in steering of gear box.
		19.4 Troubleshooting of steering system.
20	Illustrate the brake system and defects in a vehicle brake system and perform repairing, servicing, parts replacement, and adjustment of Brake system.	20.1 Check and adjust parking brake, and service brakes. Dismantle wheel brake assembly– remove old lining and fit new one.
		20.2 Remove and refit vacuum boosters.
		20.3 Overhaul – master cylinder, Wheel cylinder & calliper pistons, and wheel drum.
		20.4 Bleed vacuum assisted hydraulic brakes.
		20.5 Overhaul – Wheel cylinders & Drum brake/disc brakes.
		20.6 Check Fail Safe System & rectify defects.
		20.7 Remove & clean brake drums. Check disc/drum run-out, Fit new cups and brake hoses / pipes assemble, adjust all wheel brakes and test for brake concern.
21	Explain importance & process and perform Transmission Oil replacement.	21. 1 Importance and grades of Transmission oil.
		21. 2 Transmission Oil replacement in different vehicles.
22	Recognise different types of engine belts, Define their importance. Perform inspection of belt faults and perform adjustment and replacement of engine belts.	22.1 Identify different type of engine belts.
		22.2 Belts inspection & replacement.
23	Define Suspension system and components. Conduct inspection for wear & tear.	23.1 Define Suspension system and carry out inspection for wear & tear.
		23.2 Explain on parts and system.
24	Explain Head Lights & its construction. Perform Headlight beam adjustment.	24.1 Head lights types & construction.
		24.2 Head light beam inspection and adjustment on vehicles.

25	Recognise &explain all the components of vehicle fitted under bonnet and Under Body. Perform dismantling and assembling under bonnet and under body components.	25.1 Under body & engine room Components location and importance and torque. 25.2 Remove and re-fit under bonnet & under body components.
26	Illustrate Engine testing parameters and perform Engine Vacuum Test, Compression Pressure Test, and Engine Oil Pressure Test of different Engines.	26.1 Engine Vacuum Test, Compression Pressure Test, Engine Oil Pressure Test of different engines.
27	Remove Battery from vehicle, inspect for defects and deficiencies, top-up electrolyte, perform battery tests, and re-fit after servicing / cleaning.	27.1 Remove battery from vehicle, inspect body condition, checking electrolyte level. 27.2 Battery electrolyte level (top up). 27.3 Test battery performance. 27.4 Clean & service battery and re-fit.
28	Explain Automobile Electricals. Check wiring with the help of wiring diagrams, and perform various electrical testing & inspection. Conduct Battery Function Test and charging.	28.1 Reading wiring diagrams. 28.2 Voltage measurement, current & Resistance measurement. 28.3 Battery - Function, Testing & Charging procedure. 28.4 Components of starting system.
	SECOND YEAR	
29	Recognise different types of engines and illustrate the difference between Petrol & Diesel engine. Describe VVT system and its function.	29.1 Recognise different types of engines. 29.2 Illustrate difference between petrol and diesel engine. 29.3 Describe VVT system and function of VVT system.
30	Illustrate Petrol engine and components. Test petrol engine and take readings of various instruments fitted in vehicle. Perform	30.1 Identification of petrol engine Components. 30.2 Practice on starting and stopping of Petrol engines. Observe and report the Reading of tachometer, odometer, temp and fuel gauge under ideal and on Load Condition. 30.3 Removing a petrol engine from a Motor vehicle. Dismantling

	dismantling of engine, inspecting the condition of components and assembling the engine.	cylinder head for inspection.
		30.4 Removing of piston and Connecting rods from engine. Check Piston rings and piston condition as per service manual.
		30.5 Checking cylinder bore wear for Oval-T and taper.
		30.6 Checking valves and valve springs
		30.7 Assembling valves and cylinder head and adjusting tappet clearance in engine.
31	Plan & organise work to clean the fuel tank, inspect for leakage & condition. Explain the Multi Point Fuel Injection (mpfi) system and components of mpfi system. Perform the testing of mpfi system components and replace any defective part. Check the functionality of fuel system.	31.1 Cleaning of fuel tank, checking for leaks in fuel tank.
		31.2 Identification of various components of mpfi system.
		31.3 Testing of mpfi components and replacement if necessary.
		31.4 Check delivery from fuel pump.
32	Illustrate the EFI engine management, Electronic Control Unit (ECU), Sensors & mountings, and instruments & gauges on dash board. Perform setting-up ECU and testing ECU circuit, testing of all sensors, and replacing of defective sensors.	32.1 Identification of Electronic Control Unit (ECU).
		32.2 Set- up for testing, testing of ECU circuit.
		32.3 Fault finding in electronic circuit and apply remedies using diagnostic tool.
		32.4 Identification of various sensors installed in engine & it's mounting.
		32.5 Checking instruments & gauges on dash board. Rectify / replace defective gauges.
		32.6 Testing of Temperature sensor, Pressure Senor, Potentiometer, Magnetic Induction sensor, Cam Position sensor, Crank Shaft Position sensor.
33	Illustrate Diesel engine and components. Test diesel engine for compression and lube oil pressure and take readings of various instruments fitted in vehicle. Perform dismantling of engine, inspecting the condition of components, lubricating & servicing of components	33.1 Check / test – compression pressure, Lubricating oil pressure.
		33.2 Dismantle complete engine and their components.
		33.3 Check / test cylinder head & block warpage, valve leak, bearing (oil) clearance, measure bore & take decision for further action, replace – liner, valve guide, piston rings, check ring end gap& side clearance, check cam &crank shaft bend & valve timing.
		33.4 Service inlet and exhaust manifolds.
		33.5 Overhauling of cylinder head assembly, use of service manual for clearance and other parameters, practice on removing rocker arm assembly manifolds

	and assembling the engine.	33.6	Remove the valves and its parts from the cylinder head, cleaning.
		33.7	Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide –replacing the valve if necessary. Testing leaks of valve seats for leakage –dismantle rocker shaft assembly -clean &check rocker shaft-and levers, for wear and cracks and reassemble. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments.
34	Describe Diesel fuel system, components, functioning and possible faults occurs in diesel fuel system. Perform service & repair diesel fuel system.	34.1	Removing & cleaning of Fuel tanks, checking leaks in the fuel lines.
		34.2	Studying the fuel feed system in diesel engines, draining of water from water separators.
		34.3	Bleeding of air from the fuel lines, and servicing primary & secondary filters.
		34.4	Removing a fuel injection pump from an engine EFI, check fuel supply from the pump to the engine, re-set timing, fill lubricating-oil, start and adjust at the slow speed of the engine.
		34.5	Overhauling of injectors and testing of injectors.
		34.6	General maintenance of fuel injection pumps.
35	Explain engine faults, mechanical & electrical causes for different types of faults. Identify faults and perform Troubleshooting on engines.	35.1	Explain mechanical & Electrical causes of Engine-not-starting in cars and perform troubleshooting in cars.
		35.2	Troubleshooting of other faults like high fuel consumption, engine overheating, low power generation, excessive oil consumption, low or high engine oil pressure, and engine noise.
36	Describe chassis of vehicle and its components. Select appropriate tools and perform dismantling and assembling of chassis components.	36.1	Describe different parts of chassis of vehicle.
		36.2	Select different tools & equipment and perform dismantling and assembling of chassis parts.
37	Explain Clutch system, components and function of each component.	37.1	Function of clutch, various type of clutch release mechanism.
		37.2	Remove clutch plate from vehicle, check for defects &

	Perform removal of clutch from vehicle, inspection for faults, repairing of defects or replacement of clutch, re-fitting the clutch and adjustment of clutch play.		rectify/replace& refit.
		37.3	Clutch play adjustment procedure.
38	Describe Gear box of an automobile, components and functioning of gear box & components. Perform removal of gear box from vehicle, dismantling the gear box, inspection of components for wear & tear, rectification of defects, reassembling, filling lube oil, and aligning of gear selector fork. Perform removal, servicing and re-assembling of CV joint. Check Gear box for functionality.	38.1	Remove gear box from vehicle, dismantle, check, rectify, fill lubricating oil & assemble.
		38.2	Align gear selector fork and check the functionality of gear box.
		38.3	Remove CV joint, dismantle, Lubricate & refit.
39	Illustrate Rear axle, types of rear axle, components, construction and functions. Perform service & repair of Rear axle.	39.1	Remove rear axle assembly, dismantle of crown wheel, pinion and bearings, clean parts.
		39.2	Check tooth contact in the crown and pinion and adjust backlash & Assemble rear axle assembly.
40	Plan & organise work to check & correct Steering system geometry. Perform removal, service & repairing of faults, repair electronic and hydraulic power system faults of steering wheels, and re-fitting of steering system on vehicle. Carry out steering system play and backlash adjustment after fitting.	40.1	**C**heck and correct the Steering Geometry with instruments.
		40.2	Remove and refit steering boxes from vehicle.
		40.3	Check and top-up oil in Steering box.
		40.4	Check and adjusting Steering wheel play and backlash.
		40.5	Overhaul hydraulic power assisted Steering system pump, control valve & cylinder.
		40.6	Repair electronic power steering system.

41	Illustrate different types of suspension systems. Conduct inspection and perform overhauling of suspension system by removing front & rear suspension system components, check for the condition, replace or repair the faults, lubricating joints, and re-fitting of suspension system. Conduct Road-test with expert team members to identify NVH problems and perform troubleshooting of NVH problems.	41.1	Overhauling and inspection of Shackle, leaf spring, front and rear suspension.
		41.2	Overhauling and inspection of Front and rear suspension.
		41.3	Removing, inspection and Assembling of shock absorber and Strut assembly and other suspension parts.
		41.4	Lubricating a suspension system.
		41.5	Take Road test for identifying NVH related problems.
		41.6	Identifying and troubleshooting of NVH problems in vehicles.
42	Plan & organise to identify faults related to Wheel balancing & alignment in a vehicle and perform wheel balancing and alignment.	42.1	Identify faults in Wheel Alignment faults viz. Camber, Caster & Toe-in / Toe-out.
		42.2	Perform Toe adjustment of front & rear wheels.
43	Plan & organise work to explain vehicle Heating Ventilation Air-Conditioning (HVAC) system, components & functioning and perform service & repair of HVAC system faults.	43.1	Identification of Air Conditioning components, performance test on A/c unit.
		43.2	Checking charged state of Refrigerant, inspecting, adjusting an engine drive belt**,** replacing an Engine drive belt.
		43.3	Checking a heating system**,** compressor rotation test, air gap check, Refrigerant recovery evacuating.
		43.4	Charging of a/c system. Replenishing compressor oil level.
		43.5	HVAC troubleshooting, diagnosis and repair for No cooling or warm air, Cool air comes out only intermittently, Insufficient cooling.
		43.6	Abnormal noise from Compressor, Magnetic clutch, Condenser, Evaporator, Blower motor. Ac diagnosis test, High and Low Pressure test.

8. SYLLABUS

SYLLABUS – AUTOMOTIVE SERVICE & REPAIR (Flexi MoU)			
FIRST YEAR			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1	Recognize & comply safe working practices, environment regulation and housekeeping in an automobile workshop.	**Workshop Safety (32 hrs)** 1. Importance of trade training, List of tools & Machinery used in the trade. 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). 3. First Aid Method and basic training. 4. Safe disposal of waste materials like cotton waste, waste oil and battery etc. 5. Hazard identification and avoidance. 6. Safety signs for Danger, Warning, caution & personal safety message. 7. Preventive measures for electrical accidents & steps to be taken in such accidents. 8. Use of Fire extinguishers. 9. Practice and understand precautions to be followed while working in fitting jobs. 10. Safe use of tools and equipment's used in the trade.	**Workshop Safety (6 hrs)** 1. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. 2. Soft Skills, its importance and Job area after completion of training. 3. Importance of safety and general precautions observed in the in the industry/shop floor. 4. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. 5. Response to emergencies e.g.; power failure, fire, and system failure. 6. Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application. 7. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable. 8. Basic understanding on hot work, confined space work and material handling equipment.

2	Explain about the automobile industry in India. Recognize different types of vehicles, vehicle Id. Nos. (VIN) of different components of vehicles, 2-stroke & 4-stroke etc. Perform greasing, spark plug cleaning & changing, valve clearance checking, emission test, vacuum test, compression test & engine oil pressure test.	**Basics of Automobile (32 hrs)** 1. Recognise different types of Vehicles 2. Recognise different types of engine components. 3. Replace– air cleaner, oil filter & fuel filter 4. Apply Grease to parts /through greasing points (if necessary) 5. Check Spark plug and inspect H.T. cables connected to Plugs. 6. Clean, Check and Adjust sparkplug 7. Ignition Timing checking on Petrol vehicle 8. With timing light & ignition timing adjustment 9. Checking of valve clearance and adjusting valve Tappet Clearance according to the Manufacturers Specification 10. Emission Testing on petrol & diesel vehicles with the help of exhaust gas analyser 11. Engine Vacuum Test, Compression Pressure Test, Engine Oil Pressure Test	**Basics of Automobile (6 hrs)** 1. Knowledge about automobile industry. 2. Career path for the trainee in the Dealership Service Centres. 3. Understanding working of 2-stroke and 4-stroke engines 4. Types of fuel used in vehicles, spark ignition and compression ignition engines 5. Understanding of technical terms and definitions e.g. Wheel base and track, Compression ratio, Stoichiometric ratio. 6. Understanding the various components viz. Battery, Tires, Spark plugs, Air filter, Fuel filter, Oil filter, Injector, Body parts etc 7. Knowledge of vehicle assembly and Plant visit 8. Engine series & types 9. Vehicle Driving learning 10. Automobile Maintenance Schedule, requirement of periodic maintenance, familiarization with work done during service 11. Familiarization with different tools, basic equipment & measuring instruments used in workshop
3-4	Plan & organize work to illustrate Vehicle Manufacturing process and perform fabrication, welding, blanking, stamping, casting, forging, and machining, painting	**Vehicle Manufacturing (64 hrs)** 1. Brief Vehicle manufacturing process. 2. Plant visit to vehicle manufacturing industry in following departments; • Fabrication & welding shop manufacturing frames & body shell • Press shop making body shell • Casting shop making Engine	**Vehicle Manufacturing (12 hrs)** 1. Brief Vehicle manufacturing process. 2. Conveyor types, 3. Robotic welding, 4. Robotic Automation

	and assembly process.	block, Engine head • Forging shop making Crank shaft, Cam shaft and gears • Machine shop (CNCs) • Painting shop • Assembly lines assembling different components to produce a car (Trim line, Chassis assembly line, Final assembly line) • Finishing shop conducting final inspection & testing of car	
5	Illustrate Engine Classification and recognize types of engines.	**Engine (32 hrs)** 1. Recognise Engine series 2. Recognise Engine types with respect to; • Type of fuel • Cycle of operation • Number of strokes per cycle • Type of ignition • No. of cylinders • Arrangement of cylinders • Valve arrangement • Type of cooling	**Engine (6 hrs)** Engine series such as F series, and K series. 3. Engine types with respect to; • Type of fuel • Cycle of operation • Number of strokes per cycle • Type of ignition • No. of cylinders • Arrangement of cylinders • Valve arrangement • Type of cooling
6-9	Explain traffic rules & regulations and safety sign and perform Vehicle Driving and obtain driving license.	**Vehicle Driving (128 hrs)** 1. Four wheel vehicle driving lessons theory. 2. Identify Traffic sign and traffic rules 3. Learning license test 4. Permanent driving license test	**Vehicle Driving (24 hrs)** 5. Four wheel vehicle driving lessons theory. 6. Traffic sign and traffic rules
10-11	Explain, perform & maintain hand & power tools and operate equipment used in a vehicle repair workshop. Develop skills of machine setting and use of correct tools for fitting of	**Workshop Tools & Equipment (64 hrs)** 1. Working with tools used in vehicle assembly 2. Working with pneumatic tools 3. Use of Vernier calliper, Micrometre and height gauge 4. Working with hand drill, hammer punches and chisel 5. Working with drill reamer and tap	**Workshop Tools & Equipment (12 hrs)** 1. Common tools and material used in automobile workshop 2. Types and sizes of spanners, screw drivers, pliers, hammers, mallets, Allen keys, Files, chisels, wrenches and taps & dies. 3. Special purpose tools

	different type of fasteners.	6. Working with wrench screwdriver and pliers, and Allen keys. 7. Understanding of types and sizes of fasteners and picking of defined number of fasteners 8. Gap setting and checking with feeler Gauge 9. Operating of spot welding guns and other welding machines	4. Gauges 5. Files 6. Drilling machines and drills 7. Lifting machines 8. Wheel balancing mc & aligner 9. Greasing pump 10. Hydraulic jacks 11. Pneumatic guns 12. Measuring instruments 13. Special purpose tools 14. Fasteners 15. General equipment in weld shop 16. Grinding, boring machines and screw jack 17. Hydraulic presses 18. Special purpose machines
12	Illustrate vehicle maintenance schedules and its importance and list the requirements for different types of service to vehicle.	**Vehicle Maintenance Schedules (32 hrs)** 1. Identify type of service to be provided to different vehicles at service centre from Vehicle maintenance schedule. **2.** List all the requirements for different type of service to vehicle depending upon duration or running km.	**Vehicle Maintenance Schedules (6 hrs)** 1. Knowledge of Automobile maintenance schedule and requirement of periodic maintenance. 2. Familiarize with work done during vehicle service.
13-15	Explain and perform Vehicle washing and cleaning.	**Vehicle washing (96 hrs)** 1. Procedure to clean the vehicle 2. Steps to be followed for cleaning the vehicle before and after the service	**Vehicle washing (18 hrs)** 1. Vehicle cleaning procedure with Air Blow 2. Vehicle cleaning procedure of under body and engine area (under bonnet) washing 3. Vehicle Cleaning procedure of engine area (under bonnet) drying and floor mats cleaning 4. Vehicle cleaning procedure of spare wheel and trunk area cleaning 5. Vehicle cleaning procedure of top wash 6. Vehicle cleaning procedure of Interior & Exterior cleaning

			7. Vehicle cleaning procedure of Glass cleaning 8. Waxing procedure
16-21	Plan & organise to explain the details of vehicle service, requirement of tools, equipment, consumables, and components for the job and perform Vehicle Service Process.	**Vehicle Service Process (192 hrs)** 1. Personal Vehicle Safety procedure 2. PDI & Periodic Maintenance 3. Vehicle Service Schedule of various MSIL models 4. Air Filter - Working, 5. Fuel Filter - Working, 6. Engine Lubrication System 7. Spark Plug - Function, Type of spark plugs 8. Engine cooling system – working and parts of cooling system 9. Valve Clearance adjustment Valve clearance Checking process, Tappet adjustment on engine 10. Emission control and standard 11. Ignition timing adjustment and inspection	**Vehicle Service Process (36 hrs)** 1. Personal & Vehicle Safety procedure followed in shop floor 2. PDI & Periodic Maintenance Schedule of various MSIL models 3. Air Filter Cleaning process, Replacement Period & Process 4. Fuel Filter - Replacement process, Replacement period, water draining (diesel vehicles) 5. Engine Oil & Filter replacement 6. Spark Plug - Replacement, cleaning and testing process 7. Engine cooling system Coolant replacement process 8. Valve clearance adjustment - Valve Clearance checking process Tappet adjustment on engine 9. Emission checking process & Testing (Petrol & Diesel vehicles) 10. Ignition timing checking process on Petrol vehicle with timing light.
22-23	Prepare all the necessary tools and equipment and perform Wheel balancing and alignment of vehicle.	**Wheel alignment (64 hrs)** 1. Check tires, wheel bearings, ball joints, control arms bushings, shock absorbers, struts & power steering. 2. Identify components, brief working principle & operation of computerized, wheel balancing machine and wheel aligner and procedure for taking readings 3. Perform wheel balancing and wheel alignment of vehicles, take a print out.	**Wheel alignment (12 hrs)** 1. Basics about different type of tires &wheels used in vehicles, Function of tire & wheel in vehicle 2. Wheel Alignment & Wheel Balancing 3. Requirement of maintaining correct tire pressure. 4. Tire rotation, requirement & process(all models) 5. Procedure for taking readings 6. Procedures for test drive to

		4. Tests drive the vehicle to confirm the repairs.	confirm the repairs.
24-26	Plan & organise to check the faults, explain the causes and perform repairing & servicing of Steering System defects.	**Steering System (96 hrs)** 1. Check and correct the steering geometry with instruments 2. Remove and refit steering boxes from vehicle 3. Check and top-up oil in steering of gear box 4. Troubleshooting of steering system	**Steering System (18 hrs)** 1. Steering system Inspection &adjustment process 2. Introduction, basic types of steering, Steering geometry (necessity, types &effects), steering characters (over steer, under steer &neutral steer) & steering linkage. 3. Types of steering gear, power assisted steering (hydraulic & electronic) 4. Checks on steering system and fault diagnosis
27-29	Illustrate the brake system and defects in a vehicle brake system and perform repairing, servicing, parts replacement, and adjustment of Brake system	**Brake system (96 hrs)** 1. Check and adjust parking brake, and service brakes. Dismantle wheel brake assembly– remove old lining and fit new one 2. Remove and refit vacuum boosters 3. Overhaul – master cylinder, Wheel cylinder & calliper pistons, wheel drum 4. Bleed vacuum assisted hydraulic brakes 5. Overhaul – Wheel cylinders & Drum brake/disc brakes 6. Check fail safe system & rectify defects 7. Remove & clean brake drums. Check disc/drum run-out, Fit new cups and brake hoses / pipes assemble, adjust all wheel brakes and test for brake concern	**Brake system (18 hrs)** 1. Forces & momentum acting on vehicle, brake slip, braking force co-efficient, time element of braking operation. 2. Classification of brake systems, factors affecting the braking distance 3. Comparison between hydraulic drum brake & disc brake system. 4. Working Principle of brake components brake booster, and master cylinder, calliper assembly, wheel cylinder & different braking force control valves 5. Brake linings & pads 6. Brake Faults diagnostics and adjustments 7. Introduction to Anti-lock braking system (ABS).
30	Explain importance & process and perform Transmission Oil replacement	**Transmission Oil replacement (16 hrs)** 1. Importance and grades of Transmission oil 2. Transmission Oil replacement in	**Transmission Oil replacement (3 hrs)** 1. Explanation & process of replacement

		different vehicles	
30	Recognise different types of engine belts, Define their importance. Perform inspection of belt faults and perform adjustment and replacement of engine belts	**Engine belts (16 hrs)** 1. Identify different types of belts 2. Belts inspection & replacement	**Engine belts (3 hrs)** 1. Engine belts: Function of Belts, types, material, Timer belts
31-33	Define Suspension system and components. Conduct inspection for wear & tear.	**Suspension system (96 hrs)** 1. Define Suspension system and carry out inspection for wear & tear. **2.** Explain on parts and system	**Suspension system (18 hrs)** 1. Suspension system and inspection, explanation on parts and system
34	Explain Head Lights & its construction. Perform Headlight beam adjustment.	**Head Light (32 hrs)** 1. Head lights types & construction 2. Head light beam inspection and adjustment on vehicles	**Head Light (6 hrs)** 1. Head lights, types, construction 2. Beam adjustment requirement and process
35-42	Recognise & explain all the components of vehicle fitted under bonnet and Under Body. Perform dismantling and assembling under bonnet and under body components	**Under bonnet / Under Body Components (256 hrs)** 1. Under body & engine room Components location and importance and torque. 2. Remove and re-fit under bonnet & under body components	**Under bonnet / Under Body Components (48 hrs)** 1. Explain under body &Engine area (under bonnet) components& their assembly diagrams.
43	Illustrate Engine testing parameters and perform Engine Vacuum Test, Compression Pressure Test, and Engine Oil Pressure Test of different Engines.	**Engine testing (16 hrs)** Engine Vacuum Test, Compression Pressure Test, Engine Oil Pressure Test of different engines	**Engine testing (3 hrs)** 1. Engine Vacuum, Compression Pressure and Engine Oil Pressure specifications
43	Remove Battery from vehicle, inspect for defects	**Battery (16 hrs)** 1. Remove battery from vehicle, inspect body condition, check	**Battery (3 hrs)** 1. Battery – Description, Function & Testing

	and deficiencies, top-up electrolyte, perform battery tests, and re-fit after servicing / cleaning	electrolyte level 2. Battery electrolyte level (top up). 3. Test battery performance. 4. Clean & service battery and re-fit.	
44-46	Explain Automobile Electricals. Check wiring with the help of wiring diagrams, and perform various electrical testing & inspection. Conduct Battery Function Test and charging	**Automobile Electricals (96 hrs)** 1. Reading wiring diagrams 2. Voltage measurement, current & Resistance measurement 3. Battery - Function, Testing & Charging procedure 4. Components of starting system	**Automobile Electricals (18 hrs)** 1. Electrical Terms & measurement, parallel & series circuits & Electrical symbols, Wiring diagrams 2. Function of multi-meter, Use of multi-meter 3. Battery - Function, Testing & charging procedure 4. Starting system
47	**Project work** a) Make a chart showing different types of vehicles / automobiles. b) Make chart explaining power transmission in a vehicle. c) Prepare models of different types of chassis or frames of vehicles. d) Prepare working model of battery charging system. e) Prepare a working model of lead-acid battery. f) Prepare a model of Steering system. g) Make charts of how catalytic convertor works or how a muffler works.		
48-51	**Revision**		
52	**Examination**		

SYLLABUS – AUTOMOTIVE SERVICE & REPAIR (Flexi MoU)			
SECOND YEAR			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
53-54	Recognize different types of engines and illustrate the difference between Petrol & Diesel engine. Describe VVT system and its function.	**Introduction to engine (64 hrs)** 1. Recognise different types of engines. 2. Illustrate difference between petrol and diesel engine 3. Describe VVT system and function of VVT system.	**Introduction to engine (12 hrs)** 1. Classification of engines 2. Basic engine terminology 3. Comparison between petrol engine &Diesel engine 4. VVT system 5. Emission standards 6. Valve clearance adjustment
55-56	Illustrate Petrol engine and components. Test petrol engine and take readings of various instruments fitted in vehicle. Perform dismantling of engine, inspecting the condition of components and assembling the engine.	**Petrol engine (64 hrs)** 1. Identification of petrol engine Components. 2. Practice on starting and stopping of Petrol engines. Observe and report the Reading of tachometer, odometer, temp and fuel gauge under ideal and on Load Condition. 3. Removing a petrol engine from a Motor vehicle. Dismantling cylinder head for inspection. 4. Removing of piston and Connecting rods from engine. Check Piston rings and piston condition as per service manual 5. Checking cylinder bore wear for Oval-T and taper 6. Checking valves and valve springs, 7. Assembling valves and cylinder head and adjusting tappet clearance in engine	**Petrol engine (12 hrs)** 1. 4-stroke spark-ignition engines-basic, 4-stroke principles. 2. Spark-ignition engine components basic engine components, engine cams & cam shaft, engine power transfer, and engine components. 3. Intake & exhaust systems – carburetted systems, electronic fuel injection systems, exhaust systems. Intake system components, air cleaners, 4. Carburettor, self-starting system components and sensors. 5. Gasoline fuel systems: description of Gasoline fuel, gasoline fuel characteristics, stoichiometric ratio, fuel supply system,
57-58	Plan & organise work to clean the	**Electronic fuel injection (EFI) (64 hrs)** 1. Cleaning of fuel tank, checking for	**Electronic fuel injection (EFI) (12 hrs)**

	fuel tank, inspect for leakage & condition. Explain the Multi Point Fuel Injection (mpfi) system and components of mpfi system. Perform the testing of mpfi system components and replace any defective part. Check the functionality of fuel system.	leaks in fuel tank. 2. Identification of various components of mpfi system. 3. Testing of mpfi components and replacement if necessary 4. Check delivery from fuel pump.	1. Introduction to Electronic Fuel Injection (EFI) fuel supply system, basic EFI principles, air supply, air volume, multipoint injection system (mpi/mpfi), simultaneous injection, efficient combustion 2. EFI fuel supply system components -Fuel pumps, fuel filters, tanks & lines, 3. Fuel lines, fuel rail, fuel Pressure Regulator, injectors, EFI sensors, idle air control devices.
59-61	Illustrate the EFI engine management, Electronic Control Unit (ECU), Sensors & mountings, and instruments & gauges on dash board. Perform setting-up ECU and testing ECU circuit, testing of all sensors, and replacing of defective sensors	**EFI engine management (96 hrs)** 1. Identification of Electronic Control Unit (ECU). 2. Set- up for testing, testing of ECU circuit. 3. Fault finding in electronic circuit and apply remedies using diagnostic tool. 4. Identification of various sensors installed in engine & it's mounting. 5. Checking instruments & gauges on dash board. Rectify / replace defective gauges. 6. Testing of Temperature sensor, Pressure Senor, Potentiometer, Magnetic Induction sensor, Cam Position sensor, Crank Shaft Position sensor.	**EFI engine management (18 hrs)** 1. Introduction to EFI engine management, EFI operation modes, electronic fuel injection, idle speed control systems, Feedback & looping, cold start systems, 2. Electrical functions, EFI wiring diagram 3. **Electronic control unit (ECU) –** EFI System ECU, electronic control unit settings, malfunction indicator lamp. 4. Description of on-board diagnostic system. Importance of Diagnostic Trouble Code (DTC) & its general format. Use of Diagnostic tool and retrievals of codes. 5. **EFI sensors**- Intake Temperature sensor, Mass Air Flow sensor, Manifold 6. Absolute Pressure sensor, Throttle Position sensor, Exhaust Gas Oxygen sensor, Crank Position sensor, Hall Effect Voltage sensor.

62-64	Illustrate Diesel engine and components. Test diesel engine for compression and lube oil pressure and take readings of various instruments fitted in vehicle. Perform dismantling of engine, inspecting the condition of components, lubricating & servicing of components and assembling the engine.	**Diesel engine (96 hrs)** 1. Check / test – compression pressure ,Lubricating oil pressure 2. Dismantle complete engine and their components 3. Check / test cylinder head & block warpage, valve leak, bearing (oil) clearance, measure bore & take decision for further action, replace – liner, valve guide, piston rings, check ring end gap& side clearance, check cam &crank shaft bend & valve timing 4. Service inlet and exhaust manifolds 5. Overhauling of cylinder head assembly, use of service manual for clearance and other parameters, practice on removing rocker arm assembly manifolds. 6. Remove the valves and its parts from the cylinder head, cleaning. 7. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide –replacing the valve if necessary. Testing leaks of valve seats for leakage –dismantle rocker shaft assembly -clean &check rocker shaft-and levers, for wear and cracks and reassemble. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments.	**Diesel engine (18 hrs)** 1. Description and constructional feature of cylinder head, importance of cylinder head design, type of diesel combustion chambers, effect on size of intake & exhaust passages, head gaskets. 2. Importance of turbulence. Turbocharger & oil cooler 3. **Valves & valve trains-** description and Function of engine valves, different types, materials, type valve operating mechanism, importance of valve seats**,** valve seats inserts in cylinder heads**,** importance of valve rotation**,** valve stem oil seals, size of intake valves, valve trains, valve- timing diagram, concept of variable valve timing. Description of camshafts & drives**,** description of overhead camshaft**,** importance of cam lobes**,** timing belts &chains**,** timing belts & tensioners. 4. Procedure for – dismantling, checking, 5. Assembling & testing of diesel engines
65	Describe Diesel fuel system, components, functioning and	**Diesel fuel systems (32 hrs)** 1. Removing & cleaning of Fuel tanks, checking leaks in the fuel lines.	**Diesel fuel systems (6 hrs)** 1. Description and function of diesel fuel Injection, fuel characteristics**,** concept of

	possible faults occurs in diesel fuel system. Perform service & repair diesel fuel system.	2. Studying the fuel feed system in diesel engines, draining of water from water separators. 3. Bleeding of air from the fuel lines, and servicing primary & secondary filters. 4. Removing a fuel injection pump from an engine EFI, check fuel supply from the pump to the engine, re-set timing, fill lubricating-oil, start and adjust at the slow speed of the engine. 5. Overhauling of injectors and testing of injectors. 6. General maintenance of fuel injection pumps.	quiet diesel technology & clean diesel technology. 2. **Diesel fuel system components** 3. Description and function of diesel tanks & lines diesel fuel filters**,** water separator lift pump plunger pump priming pump 4. Inline injection pump**,** distributor-type injection pump**,** diesel injectors**,** glow plugs 5. **Electronic diesel control-** electronics 6. Diesel control systems**,** common rail diesel injection (crdi) system**,** hydraulically actuated electronically controlled unit injector (heui), diesel injection system. Sensors, actuators and ECU (electronic control unit used in diesel engines. 7. Engine Immoblizer control system.
66-73	Explain engine faults, mechanical & electrical causes for different types of faults. Identify faults and perform Troubleshooting on engines.	**Troubleshooting of Engine (256 hrs)** 1. Identify mechanical & Electrical causes of Engine-not-starting in cars and perform troubleshooting in cars. 2. Troubleshooting of other faults like high fuel consumption, engine overheating, low power generation, excessive oil consumption, low or high engine oil pressure, and engine noise.	**Troubleshooting of Engine (48 hrs)** 1. Causes and remedy for engine Not Starting – mechanical & electrical causes, high fuel consumption, engine overheating, low power generation, excessive oil consumption, low/high engine oil pressure, engine noise.
74	Describe chassis of vehicle and its components. Select appropriate tools and perform dismantling and	**Chassis system (32 hrs)** 1. Describe different parts of chassis of vehicle. 2. Select different tools & equipment and perform	**Chassis system (6 hrs)** 1. Units& definition of force, work, power, Torque & pressure. 2. Power flow from engine to

	assembling of chassis components	dismantling and assembling of chassis parts	wheels
75	Explain Clutch system, components and function of each component. Perform removal of clutch from vehicle, inspection for faults, repairing of defects or replacement of clutch, re-fitting the clutch and adjustment of clutch play.	**Clutch (32 hrs)** 1. Function of clutch, various type of clutch release mechanism 2. Remove clutch plate from vehicle, check for defects & rectify/replace& refit. 3. Clutch play adjustment procedure.	**Clutch (6 hrs)** 1. Description of clutch. Functions of different parts of the clutch assembly. Clutch linings material. Power flow in clutch plate. 2. Clutch operating mechanisms-manual & Hydraulic 3. Clutch faults
76-81	Describe Gear box of an automobile, components and functioning of gear box & components. Perform removal of gear box from vehicle, dismantling the gear box, inspection of components for wear & tear, rectification of defects, reassembling, filling lube oil, and aligning of gear selector fork. Perform removal, servicing and re-assembling of CV joint. Check Gear box for functionality.	**Gear Box (192 hrs)** 1. Remove gear box from vehicle, dismantle, check, rectify, fill lubricating oil & assemble 2. Align gear selector fork 3. Remove CV joint, dismantle, Lubricate & refit	**Gear Box (36 hrs)** 1. Type of gears and their application. 2. Advantages and disadvantages-gear ratio 3. Types of gear box 4. Working principle of synchromesh gearboxes 5. Gear selection mechanism 6. Lubrication of transmission system 7. Gear box faults

82-83	Illustrate Rear axle, types of rear axle, components, construction and functions. Perform service & repair of Rear axle.	**Rear Axle (64 hrs)** 1. Remove rear axle assembly, dismantle of crown wheel, pinion and bearings, clean parts. 2. Check tooth contact in the crown and pinion and adjust backlash & Assemble rear axle assembly	**Rear Axle (12 hrs)** 1. Types of bearings, maintenance, their characteristics & application 2. Working principle of constant velocityJoints 3. Working principle of differential 4. Faults in differential, CV joints & drive shafts
84-85	Plan & organise work to check & correct Steering system geometry. Perform removal, service & repairing of faults, repair electronic and hydraulic power system faults of steering wheels, and re-fitting of steering system on vehicle. Carry out steering system play and backlash adjustment after fitting.	**Steering system (64 hrs)** 1. **C**heck and correct the steering 2. Geometry with instruments 3. Remove and refit steering boxes 4. From vehicle 5. Check and top-up oil in Steering box. 6. Check and adjusting Steering wheel play and backlash. 7. Overhaul hydraulic power assisted Steering system pump, control valve & cylinder. 8. Repair electronic power steering system	**Steering system (12 hrs)** 1. Function of steering system 2. Rack & pinion steering system 3. Hydraulic power steering system 4. Electronic power steering system
86-90	Illustrate different types of suspension systems. Conduct inspection and perform overhauling of suspension system by removing front & rear suspension system components, check for the condition, replace or repair the faults,	**Suspension System& NVH (160 hrs)** 1. Overhauling and inspection of Shackle, leaf spring, front and rear suspension 2. Overhauling and inspection of Front and rear suspension 3. Removing, inspection and Assembling of shock absorber and Strut assembly and other suspension parts. 4. Lubricating a suspension system. 5. Take Road test for identifying NVH related problems **6.** Identifying NVH problems with expert team members and	**Suspension System& NVH (30 hrs)** 1. Function of suspension system. Components of suspension system. Types of suspension systems. Inspection of suspension system. 2. Noise, vibration and harshness (NVH): Explain basic terms viz. Cycle, Frequency (hertz), Amplitude, Free vibration, Forced vibration, Natural frequency, Resonance, and Damping. 3. Road test with procedure for identifying related problems

	lubricating joints, and re-fitting of suspension system. Conduct Road-test with expert team members to identify NVH problems and perform troubleshooting of NVH problems.	troubleshooting of NVH problems in vehicles	
91-92	Plan & organise to identify faults related to Wheel balancing & alignment in a vehicle and perform wheel balancing and alignment.	**Wheel Alignment (64 hrs)** **1.** Identify faults in Wheel Alignment faults viz. Camber, Caster & Toe-in / Toe-out **2.** Perform Toe adjustment of front & rear wheels.	**Wheel Alignment (12 hrs)** 1. Understand Wheel Alignment faults viz. Camber, Caster & Toe-in / Toe-out. 2. Power flow from engine to wheels
93-98	Plan & organise work to explain vehicle Heating Ventilation Air-Conditioning (HVAC) system, components & functioning and perform service & repair of HVAC system faults.	**Heating Ventilation Air Conditioning (HVAC) (192 hrs)** 1. Identification of Air Conditioning components, performance test on A/c unit 2. Checking charged state of 3. Refrigerant, inspecting, adjusting an engine drive belt**,** replacing an Engine drive belt. 4. Checking a heating system**,** compressor rotation test, air gap check, Refrigerant recovery evacuating 5. Charging of a/c system. Replenishing compressor oil level. 6. HVAC troubleshooting, diagnosis and repair for No cooling or warm air, Cool air comes out only intermittently, Insufficient cooling, 7. Abnormal noise from Compressor, Magnetic clutch, Condenser, Evaporator, Blower motor. Ac diagnosis test, High and Low	**Heating Ventilation Air Conditioning (HVAC) (36 hrs)** 1. Ac system layout &components explanation 2. Location of various ac components in Vehicle 3. Auto ac Diagnosis & repair of ac system 4. Recharging ac refrigerant using recovery machine 5. Compressor oil (lubricant)property and quantity 6. Ac system performance inspection 7. HVAC legislation 8. **V**ehicle heating, Ventilation & cooling systems**,** basic air-conditioning principles**,** air-conditioning capacity**,** air-conditioning refrigerant**,** Humidity 9. Description and function of fixed orifice**,** Control devices**,**

		Pressure test	thermostatic expansion valve system, thermal expansion valves, air-conditioning compressors, condensers & evaporators, receiver drier, lines &hoses, thermostat, refrigerants, pressure switches, heating elements 10. Air-conditioning ECU, ambient Air Temperature sensor, Automatic Climate Control sensors, Evaporator Temperature Sensor, Blower speed control, Ventilation Systems.
99	**In-plant training/ Project work** a) Make completer electrical circuit of an automobile showing all electrical equipment connected and demonstrate their working. b) Make a chart showing different systems in a car. c) Prepare model of side indicator lights or parking lights. d) Test emission of diesel and petrol vehicles and prepare reports. e) Prepare a model of suspension system. f) Prepare a model for explaining functioning of differential. g) Make charts of how catalytic convertor works or how a muffler works.		
100-103	**Revision**		
104	**Examination**		

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

FIRST YEAR		
S No.	**Workshop Calculation (40hrs) and Science (40hrs) Total 80 hrs**	**Engineering Drawing (80 hrs)**
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	**Fractions**: Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments : their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, and Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
3.	**Square Root**: Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines : - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
4.	**Ratio &Proportion**: Simple calculation on	Drawing of Geometrical Figures: Definition,

	related problems.	nomenclature and practice of - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Dimensioning: - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text
7.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi-circle, Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere.	Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	**Trigonometry:** Trigonometrically ratios, measurement of angles. Trigonometric tables	Sizes and Layout of Drawing Sheets - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
9.	**Material Science** : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View

	Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	- Isometric view
10.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Symbolic Representation (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Welded, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
11.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Construction of Scales and diagonal scale
12.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Practice of Lettering and Title Block
13.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	Dimensioning practice: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
14.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, and their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse& Parabola)

15.	**<u>Levers and Simple Machines:</u>** levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
16.	----------	Free Hand sketch of hand tools and measuring tools used in respective trades.
17.	----------	Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification.
18.	----------	Drawing of Orthographic projection from isometric/3D view of blocks
19.	----------	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
20.	----------	Drawing details of two simple mating blocks and assembled view.

SECOND YEAR		
S No.	**Workshop Calculation (40 hrs) and Science (40 hrs) Total 80 hrs**	**Engineering Drawing (80 hrs)**
1.	GEOMETRY: Geometrical construction & theorem: division of line segment, parallel lines, similar angles, perpendicular lines, isosceles triangle and right angled triangle.	- Revision of first year topics.
2.	- Area of cut-out regular surfaces: circle and segment and sector of circle.	- Machined components; concept of fillet & chamfer; surface finish symbols.
3.	- Area of irregular surfaces. - Application related to shop problems.	- Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
4.	- Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple machine blocks.	- Free hand Sketches for bolts, nuts, screws and other screwed members.
5.	- Material weight and cost problems related to trade.	- Free hand Sketching of foundation bolts and types of washers.
6.	- Finding the value of unknown sides and angles of a triangle by Trigonometrical method.	- Standard rivet forms as per BIS (Six types).
7.	- Finding height and distance by trigonometry.	- Riveted joints-Butt & Lap (Drawing one for each type).
8.	- Application of trigonometry in shop problems. (viz. taper angle calculation).	- Orthogonal views of keys of different types
9.	**Graph:** - Read images, graphs, diagrams – bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	- Free hand Sketches for simple pipe, unions with simple pipe line drawings.
10.	Simple problem on Statistics: - Frequency distribution table - Calculation of Mean value. - Examples on mass scale productions. -Cumulative frequency -Arithmetic mean	- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related tools/job/exercises with the dimensions from the given sample or models.
11.	- Forces definition. - Compressive, tensile, shear forces and simple problems.	-Free hand sketch of trade related components / parts (viz., single tool post for the lathe, etc.)

	-Stress, strain, ultimate strength, factor of safety. -Basic study of stress-strain curve for MS.	
12.	- Temperature measuring instruments. Specific heats of solids & liquids.	- Study of assembled views of V-blocks with clamps.
13.	- Thermal Conductivity, Heat loss and heat gain.	- Study of assembled views of shaft and pulley.
14.	- Average Velocity, Acceleration & Retardation. - Related problems.	- Study of assembled views of bush bearing.
15.	- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	- Study of assembled views of a simple coupling.
16.	Acceptance of lot by sampling method (within specified limit size) with simple examples (not more than 20 samples).	- Free hand Sketching of different gear wheels and nomenclature.
17.	- Friction- co-efficient of friction, application and effects of friction in Workshop practice. **Centre of gravity** and its practical application.	- Free hand Details and assembly of simple bench vice.
18.	- Magnetic substances- natural and artificial magnets. - Method of magnetization. Use of magnets.	- Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.
19.	- Electrical insulating materials. - Basic concept of earthing.	- Simple exercises relating missing symbols. - Missing views
20.	- Transmission of power by belt, pulleys & gear drive. - Calculation of Transmission of power by belt pulley and gear drive.	- Simple exercises related to missing section.
21.	- Heat treatment and advantages.	-Free hand sketching of different types of bearings and its conventional representation.
22.	Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure	- Solution of NCVT test. - Simple exercises related to trade related symbols. - Basic electrical and electronic symbols
23.	----------	- Study of drawing & Estimation of materials.
24.	----------	- Solution of NCVT test papers.

9.2 EMPLOYABILITY SKILLS

CORE SKILL – EMPLOYABILITY SKILL (160 Hrs)	
FIRST YEAR	
1. English Literacy	**Duration: 30 hrs.** **Marks : 09**
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, voice change, change of tense, Spellings
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking/ Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happenings, job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing on messages and filling in message forms, Greeting and introductions, office hospitality, Resumes or curriculum vitae essential parts, letters of application reference to previous communication.
2. IT Literacy	**Duration: 30 hrs.** **Marks : 09**
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, the user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc., Use of Common applications.
Word Processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks),

	Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cybercrimes.
3. Communication Skills	**Duration: 22 hrs.** **Marks : 07**
Introduction to Communication Skills	Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication-characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills.
Motivational Training	Characteristics essential to achieving success. The power of positive attitude. Self-awareness Importance of commitment Ethics and values Ways to motivate oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
4. Entrepreneurship Skills	**Duration: 18 hrs.** **Marks : 06**
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise and relation to the economy, Source of business ideas, Entrepreneurial opportunities, and the process of setting up a business.

Project Preparation & Marketing Analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Difference between small scale &large scale business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institution's Support	Preparation of Project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the Policies/Programmed, procedure andthe available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity	**Duration: 15 hrs. Marks : 05**
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation – How it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education	**Duration: 20 hrs. Marks : 06**
Safety & Health	Introduction to Occupational Safety and Health, importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident &Safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
First Aid	Care of injured &sick at the workplaces, First-Aid and Transportation of sick person.

Basic Provisions	Idea of basic provision legislation of India. Safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global Warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in-house environment.
7. Labor Welfare Legislation	**Duration: 10 hrs.** **Marks : 03**
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act.
8. Quality Tools	**Duration: 15 hrs.** **Marks : 05**
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT		
Automotive Service & Repair (Flexi MoU) **(For batch of 30 candidates)**		
S. NO	**TOOLS, EQUIPMENT, MACHINERIES AND VEHICLES**	**QTY**
1.	Double ended spanner set 6-32mm	05 set
2.	Ring spanner set 6-32mm	05 set
3.	Tubular spanners 8,10,12,14,16,17mm	5 nos.
4.	Socket spanners 6-32 mm with T bar and ratchet	05 set
5.	Allen keys 4-12mm in steps of 2mm	05 set
6.	Screw driver (flat) 20cm x 9mm blade	5 nos.
7.	Screw driver (flat) 30cm x 9 mm blade	5 nos.
8.	Screw driver (Philips type) 100 -300mm set of 5 pieces	05 set
9.	Hammer ball peen 0.75 kg	5 nos.
10.	Mallet hammer	5 nos.
11.	Hammer rubber	5 nos.
12.	Nose plier straight 15 cm	5 nos.
13.	Combination plier 15 cm	5 nos.
14.	Circlip plier external & contracting 6”	5 nos.
15.	Circlip plier external & contracting 7”	5 nos.
16.	Feeler gauge 20 blades metric	5 nos.
17.	Adjustable spanner 20 cm	5 nos.
18.	Spark plug spanner 12,14,17mm	5 nos.
19.	File different shapes and size of 15cm	05 set
20.	Pneumatic Gun	5 nos.
21.	Battery gun	5 nos.
22.	Socket set	5 nos.
23.	Screw Bit set	5 nos.
24.	Torque wrench 0-50 NM	01 no.
25.	Digital Multi meter	01 no.
26.	Tappet adjuster	01 no.
27.	Air compressor 200 litres capacity	01 no.
28.	Impact screw driver for flat and Philips type	01 set
29.	Pneumatic tyre inflator	01 no.
30.	Measuring Jars (Different capacity)	01 Set
31.	2 post lift (3 ton capacity)	2 nos.

32.	Desktop computers for Basic training	10 nos.
33.	Engine (Petrol MPFI) for dismantling and assembly	2 nos.
34.	Engine (Diesel DDIS) for dismantling and assembly	2 nos.
35.	Transmission for assembly and disassembly training	2 nos.
36.	4 Wheeler vehicle	2 nos.
List of Machine and equipment at the Dealer workshop		
37.	TWO POST LIFT	2 nos.
38.	WHEEL ALIGNER	1 no.
39.	WHEEL BALANCER	1 no.
40.	TYRE CHANGER	1 no.
41.	A/C RE-CYCLING EQUIPMENT	1 no.
42.	EXHAUST GAS ANALYZER (4 GAS)	1 no.
43.	SMOKE METER	1 no.
44.	AIR COMPRESSOR	1 no.
45.	CAR WASHER	1 no.
46.	VACUUM CLEANER	1 no.
47.	HYDRAULIC WASHING HOIST	1 no.
48.	UNDER CHASSIS WASHING SYSTEM	1 no.
49.	SOAP FOAM SPRAYER	1 no.
50.	OMS	1 no.
51.	EXPRESS SERVICE BAY TOOL TROLLEY	1 no.
52.	BRAKE BLEEDING EQUIPMENT	1 no.
53.	RIVE LINE SERVICE EQUIPMENT -	1 no.
54.	DRIVING SIMULATOR(Transmission oil drain & dispensing equipment)	1 no.
55.	COOLANT TRANSFUSION MACHINE	1 no.
56.	FUEL AND AIR INDUCTION EQUIPMENT(Cleaning/ Decarbonising of Fuel and air intake system)	1 no.
57.	FUEL CONSUMPTION TESTER(for both petrol and diesel vehicle)	1 no.
58.	Battery Tester	1 no.
59.	Green Power Jump Starter	1 no.

Note: - Preferably all tools must be hardened, toughened and ground.

TOOLS & EQUIPMENT FOR EMPLOYABILITY SKILLS		
S No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	30 nos.
2.	UPS - 500VA	10 nos.
3.	Scanner cum Printer	1 no.
4.	Computer Tables	30 nos.
5.	Computer Chairs	30 nos.
6.	LCD Projector	1 no.
7.	White Board 1200mm x 900mm	1 no.

ANNEXURE - II

MSIL - Maruti Suzuki Training Academy

Trainee Internal Assessment Report

Name :		**Batch No:**	
Card ID No :		**Dept:**	
Attendance % :			

Quarters	Month	Attend %	Month	Attend %	Month	Attend %	Quarterly Average Attend. %
Qtr-1							
Qtr-2							
Qtr-3							
Qtr-4							

General Assessment **Assessment Period :**

S.No	ATTRIBUTES		Score Qtr-1	Score Qtr-2	Score Qtr-3	Score Qtr-4	Score Sum of 4-Qtrs
1	**Safety**	Knowledge, follow safety precautions and rules					
2	**Sense of Responsibility**	Does he obey Sup/Line i/c instructions					
		Does he attend shift start meetings regularly					
		Does he take supervisors feedback properly					
		Whether he takes planned leaves					
		Does he participates in new drives					
		Does he take care in handling tools					
		Is Punctual					
		Positive, Behaviour , response, learning					
		Maintain 5S at his work station					
		Co-operation - Consider team work, willingness to work with and for others					
		Able to identify and report irregularities at his work place					
3	**Method**	Follow WIS/MOS					
		Able to check faults of previous station					
		Understands tools/equipment functions and its different parts					
		Able to perform the job independently					
4	**Speed**	Able to match line "TACT" time					
		Willingness to learn/flexibility for alternate job					
		Work completion/target achievement					
5	**Quality**	Able to contain defects					
		Awareness about GCA/PDI					
		Skill acquired during "On job training"					
		Total Score					
		Max. Marks					

(Fill score in relevant box) **Excellent : 4, Very Good : 3, Good : 2, Fair : 1, Need Improvement : 0**

Remarks (Supervisor): (Mention achievement/Critical incidents)

Remarks (Shift Incharge/Dept, Manager):

Remarks (MSTA Training Coordinator):