

MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)

COMPETENCY BASED CURRICULUM

(Duration: 2 Years)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – AUTOMOBILE



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

MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)

(Revised in 2018)

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NSQF LEVEL - 5

Skill India
कौशल भारत - कुशल भारत

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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ACKNOWLEDGEMENT

The DGT sincerely express appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum.

Special acknowledgement is expended by DGT to the following expert members who had contributed immensely in this curriculum.

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Sl. No.	Topics	Page No.
1.	Background	1-2
2.	Training System	3-7
3.	Job Role	8
4.	NSQF Level Compliance	9
5.	General Information	10
6.	Learning Outcome	11-12
7.	Learning Outcome with Assessment Criteria	13-15
8.	Syllabus	16-23
9.	Syllabus - Core Skill	24-31
	9.1 Core Skill – Workshop Calculation & Science and Engineering Drawing	
	9.2 Core Skill – Employability Skill	
10.	Details of Competencies (On-Job Training)	32-33
11.	List of Trade Tools & Equipment Basic Training - Annexure I	34-41
12.	Format for Internal Assessment -Annexure II	42

1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

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

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

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

1.2 Changes in Industrial Scenario

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

1.3 Reformation

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

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



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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. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

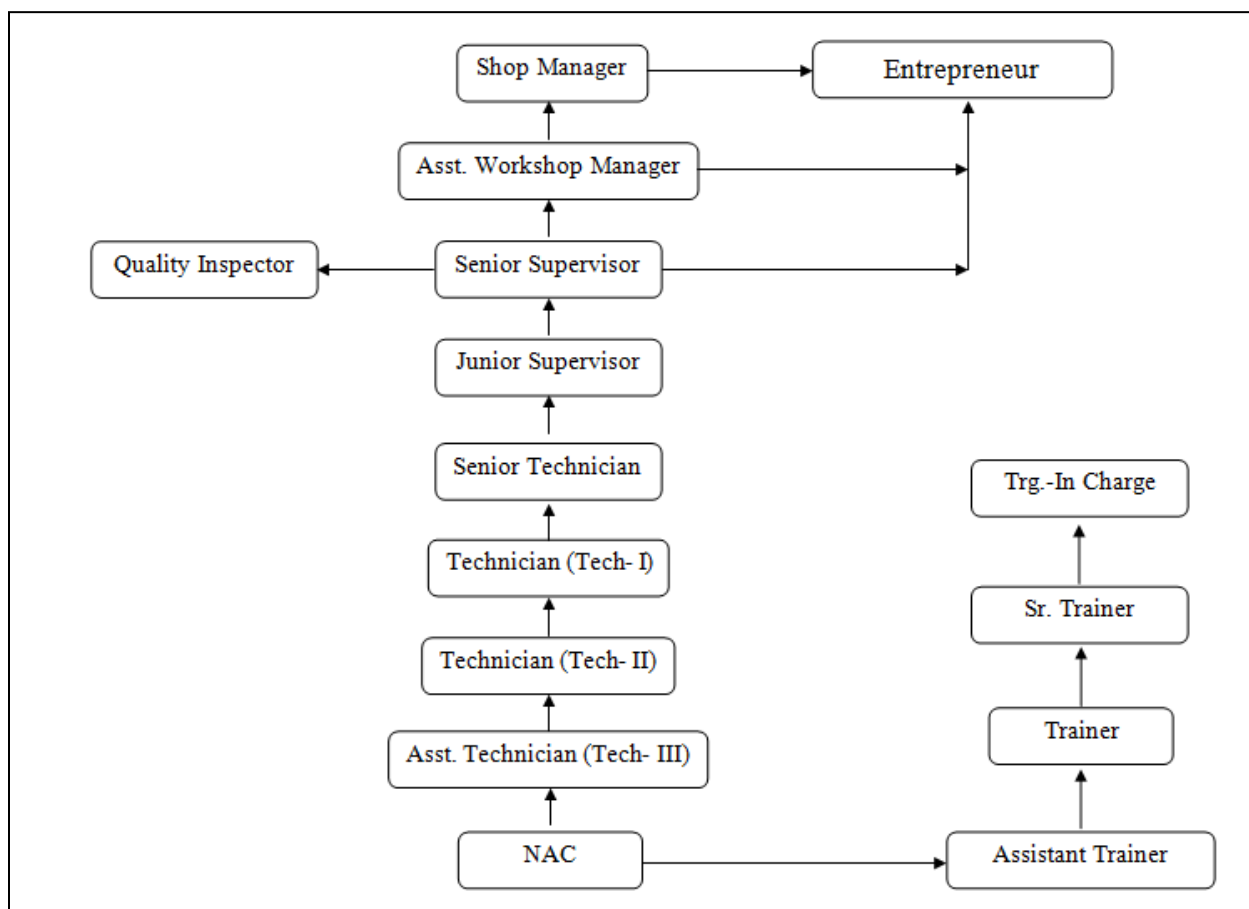
Mechanic Automobile (Advanced Petrol Engine) trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Block) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

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

2.2 CAREER PROGRESSION PATHWAYS:

- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of one year (*Basic Training and On-Job Training*) :-

Total training duration details: -

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

Mechanic Automobile (Advanced Petrol Engine)

A. Basic Training

For 02 yrs. Engg. Course :- (Total 06 months: 03 months in 1st yr. + 03 months in 2nd yr.)

For 01 yr. Engg. course :- (Total 03 months: 03 months in 1st yr.)

Sl. No.	Course Element	Total Notional Training Hours	
		For 02 yrs. course	For 01 yr. course
1	Professional Skill (Trade Practical)	550	275
2	Professional Knowledge (Trade Theory)	240	120
3	Workshop Calculation & Science	40	20
4	Engineering Drawing	60	30
5	Employability Skills	110	55
	Total (including Internal Assessment)	1000	500

B. On-Job Training:-

For 02 yrs. Engg. Course :- (Total 18 months: 09 months in 1st yr. + 09 months in 2nd yr.)

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. Engg. course :- (Total 12 months)

Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 Engg. yrs. course	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. Engg. course	500 hrs.	2080 hrs.	2580 hrs.

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

Mechanic Automobile (Advanced Petrol Engine)

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

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

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

Performance Level	Evidence
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Mechanic Automobile (Advanced Petrol Engine)

(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Weightage in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weightage in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

Brief description of Job roles:

Mechanic, Petrol Engine

Mechanic, Petrol Engine; Petrol Engine Fitter, locates defects, repairs, and overhauls stationary petrol engines for correct performance to drive pumps, generators, propulsion shafts, etc., checks Petrol engine to locate defects. Dismantles or partly dismantles it according to nature of defects and measures essential parts such as cylinder bore, crank pins, pistons etc., using cylinder gauge, micrometre and other appropriate tools. Gets cylinders rebored, valve seats refaced and liners filled if necessary. Fits and taps pistons in cylinders, decarbonises cylinder head and grinds valves using appropriate abrasives. Replaces or repairs worn out or damaged parts and assembles them, doing supplementary tolling as necessary to ensure accuracy of fit. Installs assembled or repaired petrol engine in position, sets timings, fits accessories, adjusts tappets, carburettor, fan belt etc. and connects it to propulsion drive. Starts petrol engine, tunes it precisely and runs it at prescribed or set standard making necessary adjustments. Observes different readings such as temperature, fuel level, oil pressure etc. for optimum performance. Checks, adjusts and lubricates equipment periodically and performs other operations to keep petrol engine in good working order. May rebore petrol engine, reface valve seats, anneal pipes, braze or solder parts etc.

Reference NCO - 2015: 7233.0300- Mechanic, Petrol Engine

4. NSQF LEVEL COMPLIANCE

NSQF level for MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE) trade under ATS: **Level 5**

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

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

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

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



The Broad Learning outcome of Mechanic Automobile (Advanced Petrol Engine) trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level- 5 descriptor is given below:

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

5. GENERAL INFORMATION

Name of the Trade	Mechanic Automobile (Advanced Petrol Engine)
NCO - 2015	7233.0300
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	3months+ 9 months (Block - I). 3 months+9 months (Block – II)
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months Total duration of Basic Training: 6 months
Duration of On-Job Training	a) Block–I: 9 months b) Block – II : 9 months Total duration of Practical Training: 18 months
Entry Qualification	Passed 10 th Class Examination
Selection of Apprenticeship	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for basic Training	As per related trade of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	One year
CTS trades eligible for Mechanic Automobile (advanced petrol engine) Apprenticeship	Mechanic (Motor Vehicle)

Note:

- Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.
- For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT. -up with ITIs having such specific trade and affiliated to NCVT.

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Mechanic Automobile (Advanced Petrol Engine) course of 02 years duration under ATS.

Block I& II:

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and 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 & social growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

BLOCK – I

1. Plan & perform basic fastening and fitting operations using various tools and equipments used in automotive workshop.
2. Trace and test simple electrical components and circuits and assemble to ensure functionality of system.
3. Diagnose and troubleshoot the cooling system faults, repair/replace the defective components and check functionality of system.

Mechanic Automobile (Advanced Petrol Engine)

4. Diagnose and troubleshoot the lubricating system faults, repair/replace the defective components and check functionality of system.
5. Trace and test charging system circuits, service the charging system components and check for its functionality.
6. Trace and test starting system circuits, service the starting and ignition system components and check for its functionality.
7. Diagnose fuel system faults and repair/replace the components.
8. Overhaul and service the vehicle air conditioning system components and check functionality of system.

BLOCK – II

9. Diagnose petrol engine problems by carry out vacuum, compression and oil pressure tests and concluding the results.
10. Plan and overhaul petrol engine and check functionality and perform petrol engine tune up.
11. Trace and test electronic components and circuits and assemble to ensure functionality of system.
12. Test functionality of multi point fuel injection components of petrol vehicle and repair/replace defective components.
13. Diagnose the problems with intake and exhaust system components and repair/replace the defective components.
14. Perform service and overhauling of transmission system and repair/replace defective components.
15. Diagnose automatic transmission wiring system problems, test and analyze test report for proper functioning.
16. Carry out overhauling of vehicle chassis system includes steering, suspension and braking system and check functionality.
17. Diagnose power steering system problems and service the components and check for its functionality.
18. Diagnose and trouble shoot Anti-Lock System problem of a vehicle.
19. Carry out removal, repair and assembling, wheel balancing activities of tyres and tubes of a vehicle.
20. Diagnose problems with vehicle comfort systems and test for its functionality.
21. Diagnose LPG system problems test the components and check its functionality.
22. Diagnose CNG system problems test the components and check its functionality.
23. Identify the components of electric and hybrid vehicle components.

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Recognize & comply 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 off 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 of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to 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. Understand, explain different mathematical calculation & science in the field of study including basic	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, centre of gravity, friction.

Mechanic Automobile (Advanced Petrol Engine)

electrical and	
apply in day to day work. <i>[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]</i>	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply 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. <i>[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]</i>	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 as per tool list.
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	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 such laws.
	5.3 Knows benefits guaranteed under various acts

Mechanic Automobile (Advanced Petrol Engine)

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, 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 familiarizes with the Policies /Programmes & procedure & 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/ assembly 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 OUTCOME	
<u>Block-I & II (Section:10)</u>	
<i>Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under block – I & block – II(section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of Planning (Identify, ascertain, estimate etc.); Execution (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and Checking/ Testing to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.</i>	

BASIC TRAINING (Block – I)**Duration: (03) Three Months**

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	GENERAL SHOP SAFETY Identify fuels, oils and chemicals used in the engines and accessories-handling of shop safety equipment-handling of safety devices-first aid- practice on hazard waste disposal.	Details of fuels, oils and chemicals used in the engines and accessories-properties of diesel fuel- types of fires and fire extinguishers-details of safety devices- first aid-importance of proper handling of hazard waste.
2	MEASURING SYSTEMS AND MEASUREMENTS Practice on measuring on the given jobs-measuring space with a feeler gauge-measuring the given jobs with precision measuring instruments- checking external and internal diameter and run outs-measure straightness on the given job.	Measuring systems and types-description of steel rule- description of feeler gauge- constructional details and working principle of precision measuring instruments like Vernier caliper, micrometer, bore gauge and dial gauge-description of surface plate and V blocks- importance of correct roundness-surface finish and its importance.
3	FASTENERS AND BEARINGS Practice on measuring threads with thread pitch gauge- practice on loosening and tightening of various screwing joints using screwing tools remove and replace bearings from the given jobs.	Threads- thread categorization- types of threads- types of screwed joints- types of nuts- property classes of bolts- screw locking arrangements- types and description of screwing tools-description and types different types of bearings.
4	BASIC HAND TOOLS Practice on marking and cutting of a given job- file the job to bring required size- practice on drilling, tapping and dying- reaming practice- repair damaged threads- - sharpening the tools.	Details of various types of marking and cutting tools- punch, scriber, hammer and mallets, hack saw frame and blade, chisels etc. – marking media-description of work holding devices like vices- details of various drill bits- description and types of drilling machines- details of taps ,dies and reamers- details of screw extractors- details of bench grinders-safety precautions to be observed while working with electricals, fuels, hand and power tools, lifting and carrying components and equipment.

Mechanic Automobile (Advanced Petrol Engine)

5	BASIC WELDING AND PNEUMATICS Exercise on using impact wrenches and blow gun- using an acetylene torch for heating, cutting and welding. Practice on starting and stopping of work shop equipment.	Description of air compressors, impact wrenches and blow gun- basics of gas welding, constructional and working principle of gas welding equipment- safety precautions to be observed while working with pneumatics and welding equipment. Description of workshop equipment.
6	BASIC ELECTRICAL AND ELECTRONICS Identify and interpret electrical/electronic system concern. Practice on measuring circuit voltage, ampere and resistance. Practice on measuring voltage drop. Practice on installing crimp connector and terminal end. Practice on soldering wires. Practice on testing fuses and relays- test diodes	General principles of electrical engineering- structure of atoms- voltage- current- fuses- electrical conduction- current direction- types of current- voltage drop- resistance- PTC and NTC resistors- types of resistors- ohm's law- resistor circuits- electro magnetism- electromagnetic induction- description of multimeter- function and types of relays- semiconductors- N type and P type semiconductors- description of diodes and transistors. safety precautions to be observed while working with electrical equipment.
7	Identification of different type of Vehicle. Demonstration of vehicle specification data; Identification of vehicle information Number (VIN). Demonstration of Garage, Service station equipment.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands. General servicing - vehicles washing, cleaning, oiling, greasing and lubrication of vehicle.	Auto Industry - History, leading manufacturers, development in vehicle industry, trends, new product. Definition: - Classification of vehicles on the basis of load, as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.
8	Identification of major components of engine and its accessories. Different types of Starting and Stopping Methods of Engine.	Introduction to Engine: Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I)) & spark ignition engine(S.I), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection. Technical terms used in engine, Engine

Mechanic Automobile (Advanced Petrol Engine)

		specification.
9	BATTERY Remove and connect battery terminal from a battery- clean terminals- check voltage of a battery- check cranking voltage- check charging voltage- top up distilled water up to the level- connecting two batteries in series- charging a battery – test battery- specific gravity test. LIGHTING SYSTEMS Practice on tracing wiring circuit of lighting system. Identification of various lights installed in vehicle.	Purpose of battery- types- construction and working principle of a lead acid battery- maintenance free batteries- IBS- battery ratings- battery charging methods- trouble shooting a battery. Description of Lighting system reading Instrument panel light.
10	STARTING SYSTEM Remove and replace starter- check starting system wiring harness- test ignition switch- remove and replace starter relay. CHARGING SYSTEM Check the operation of the charging system- perform voltage drop tests- remove and replace alternator- dismantle and reassemble alternator.	Study about wiring diagram of a starting system- Principle of starter- components of a starter- construction and working of starter- starter field coil design- solenoids- types and function. Study about wiring diagram of a charging system- construction and working principle of alternator- description of voltage regulator operation. Integrated Starter Generator.
11	COOLING AND LUBRICATING SYSTEM Drain, flush and refill cooling system- remove and replace drive belt and hoses- remove and replace coolant pump- remove and replace radiator and fan assembly- test thermostat. Drain engine oil- change oil filter- replace new engine oil- blotting paper test- remove and replace oil pump- remove, clean and replace oil cooler.	Engine operating temperature- requirements of cooling system- types of cooling system and its description- description of pump circulating system components- radiator and its types- Oil cooler description- expansion tank- details of radiator pressure cap- coolant pump- construction and working- fan- rigid and variable drive- electrically driven fans- viscous coupling- types of thermostat and its description Functions of a lubricating system- description of different types of lubricating systems- list out engine lubricating components- description of different types of oil pumps- oil pressure limiting valves- types of oil filtering systems and its description- description of oil cooler- crank case ventilation

Mechanic Automobile (Advanced Petrol Engine)

12	Identification of Air conditioning components. Practice on adjustment of A/C inside the cabin.	Heating Ventilation Air Conditioning (HVAC) Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, , Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air-conditioning compressors, Condensers & evaporators, Receiver drier, Lines & hoses, TX valve construction, Temperature monitoring thermostat, Pressure switches, Heating elements. Evaporator temperature sensor, Blower speed control, Ventilation systems.
13	Practice on use of Job service card. Understanding Periodic Service of Vehicle Demonstration on purchasing and ordering of spare part.	Introduction and importance of Job service card, Its parameters and its uses, Filling of job card, and formation of service report First, Second, Third and Paid Service of Vehicle. Use of Spare parts catalogue, workshop service manual price list, Procedure of Ordering items and spare parts & Billing. Idea about PD Inspection.
Revision & Examination		

Note: - More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.

कौशल भारत - कुशल भारत

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week NO	PROFESSIONAL SKILL (Trade Practical)	PROFESSIONAL KNOWLEDGE (Trade Theory)
1	INTAKE AND EXHAUST SYSTEMS Remove, clean and replace intake system- remove and replace exhaust manifold, silencer and exhaust pipe - remove and replace catalytic converter.	Description of air induction system- description of intake and exhaust manifold- details of various types of catalytic converters- details of various types of mufflers- trouble shooting in intake and exhaust systems.
2	CYLINDER HEAD ASSEMBLY Remove accessories fitted with the diesel engine- remove and dismantle cylinder head- clean and lubricate cylinder head components viz. valve, valve guide, valve seats, valve spring, timing belt, rocker arm and cam shaft - reassemble and refit cylinder head components- set valve timing- adjust valve clearance.	Description of different types engine according to valve arrangements- cylinder head design- details of arrangement of valves in engines- valve timing diagram of a diesel engines- details of arrangement of camshaft in engines- multiple valve technology- detailed description of valve components- details of camshaft drives- valve clearance- description of hydraulic valves- description of variable engine timing technology.
3	CYLINDER BLOCK ASSEMBLY Dismantle engine block components- clean and lubricate components viz. Crank shaft, main and connecting rod bearings, piston, piston rings, connecting rods, fly wheel and vibration damper- tighten cylinder head bolts-reassemble engine block assembly.	Functions of a cylinder- cylinder types and description- types of cylinder liners- description of cylinder head gasket- functions of a piston- types and material used for piston- connecting rod- functions- material and design of connecting rod- crank shaft- functions- material and design of crank shaft- fly wheel- description of vibration damper.
4	Identification of Electronic control Unit. Set up for testing. Identification of various EFI sensors installed in engine & its	Introduction to EFI Engine Management -EFI operation Modes of EFI, Electronic fuel injection, Idle speed control systems, Feedback & looping, Cold start systems, Air measurement, Air-flow monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram

Mechanic Automobile (Advanced Petrol Engine)

	mounting. Practice on tracing input sensor wiring and connectors- remove and replace sensors	Electronic control unit (ECU) - EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp. Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes. Sensors- Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor.
5	Identification of various components of MPFI system.	Introduction to Electronic fuel injection (EFI) fuel supply system, Basic EFI principles, Air supply, Air volume, Multi-point injection systems (MPI/MPFI), Simultaneous injection, Efficient combustion. Direct Injection. EFI fuel supply system components - Fuel pumps, Fuel filters, Tanks & lines, Fuel lines, Fuel rail, Fuel pressure regulator, Injectors, Tachometric relay, Thermo time switch, EFI sensors, Potentiometer, Auxiliary air valves, Idle speed control devices, Inertia sensors.
6	EMISSION CONTROL SYSTEM Demonstration of Emission control methods. Test and service an exhaust gas recirculating valve- remove and replace EGR valve- clean an EGR valve and passages.	Emission Control:- Vehicle emissions Standards- Euro and Bhart II, III, IV, V Sources of emission, Combustion, Combustion chamber design. Types of emissions: Characteristics and Effect. Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control, Exhaust gas recirculation(EGR) valve,, Controlling air-fuel ratios, Charcoal storage devices, Diesel particulate filter(DPF).Selective Catalytic Reduction (SCR), EGR VS SCR.
7	Automatic transmission Identification of Automatic transmission components and related sensors. Tracing wiring circuit in Automatic Transmission Electronic Power Steering Identification of EPS	Description, construction and function of Transmission system. Automatic Transmissions - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches. Planetary gearing Electronic control transmission

Mechanic Automobile (Advanced Petrol Engine)

	components and related sensors. Tracing wiring circuit in EPS.	Continuously variable transmission (C.V.T.)- Description, construction and function of steering system their movement Description of Electric power assisted steering, Basic electric power steering operation,
8	ABS Identification of ABS components and related sensors. Tracing wiring circuit in Antilock Braking system	Description, construction and function of Braking system. Electric brakes, Electro hydraulic braking (EHB), ABS brake system, Antilock braking system operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with Electronic Brake force Distribution (EBD) control unit.
9	Removing propeller shaft, & universal joints- Identify parts, reassemble & refitting to vehicle. Removing rear axle assembly from vehicle, dismantling, cleaning, and refitting. Removing wheels from vehicle, dismantling tyres and tubes, tubeless tyre assembling inflating to correct pressure.	Description and functions of Universal joints and propeller shaft, types. Care and maintenance constant velocity joints special and advantages. Description and purpose of different types of rear axles, Multi axle, special features and advantages in each type lubrication of axles, Under slung, over slung & Transaxle. Description & functions of final drive assembly crown wheel and tail pinion hypoid gear, Bevel type and worm & worm wheel and its lubrication Descriptions of differential and its principle of operation. Common troubles and their remedy in rear axle assembly. Description of wheels and tyres-types selection of tyres, ply rating, inflation pressure and carrying capacity, storage of tyres. Nitrogen gas inflating.
10	Replacing new bushes in shackle pins changing bushes in shock absorbers, cleaning & lubrication of wheel bearings, adjusting Removing kingpins and bushes replacing new bushes & lubrication of king pin bushes in the front, independent suspension system.	Frames-description and function common troubles conventional suspension system. Types of leaf springs used different types of shock absorbers. Their description, operation & maintenance. Working, construction of suspension system, Independent and conventional suspension system, torsion bar stabilizer bar, struts, bushes Air Suspension its parts, function advantages over conventional system.
11	Demonstration on Safety and precautions while working with LPG and CNG. Identification of LPG System	Popular Automotive Fuels & Alternate Fuels, What is LPG, benefits of LPG, System layout of LPG & system, Major components and their functions - Filler valves, LPG cylinder, LPG high pressure filter,

Mechanic Automobile (Advanced Petrol Engine)

	components Identification of CNG System components	Vaporizer, Gas injector rail, Select switch cum level indicator, Circuit diagram, LPG malfunctioning light, Periodic maintenance schedule, Safety Precautions - Do's & Don'ts The CNG Receptacle, Fuel Lid Switch, CNG Parts and its functions - CNG Cylinder, Cylinder valve assembly, Excess flow valve, Manual valve, Shut off valves, Fusible Plug, Pressure relief device, Pressure Gauge, Fuel Pressure sensor, CNG high pressure filter, Fuel Pressure Regulator, CNG Fuel Delivery pipe, CNG Injectors, Selector Switch, CNG Fuel filter, Coolant supply, CNG / LPG Leak detector, Working on CNG line. Comparison of CNG and LPG, Comparison of vehicle on the basis of CNG system, Octane Number, Benefits of CNG & LPG, Layout of CNG system.
12	Identify different location of various ECUs in vehicle Identify antitheft system. Practice on Identifying Proximity sensor, Parking sensor, crash sensor, Rain and Light sensor Identification of Air bag components Tracing wiring circuit of parking sensor, co-passenger sensor and seat belt.	Antitheft system, immobilizer system. Navigation system, Car radio and cassette player, car videos. Integrated communications, Proximity sensors, Reflective displays, and Global positioning satellites. Introduction, function and advantages of parking sensor, crash sensor, Rain and Light sensor, Car immobilizer system, Electric Sunroof. Description of OBD Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes. ECU Communications- Communication between different ECUs. LIN Bus, MOST Bus, CAN Bus.
13	Demonstration of Hybrid system vehicle	Explain Hybrid system Types of Hybrid in different vehicle, Location of components and parts, function of different parts and their diagnostics and replacement. Brake regeneration.
Revision & Examination		

Note: - More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	Workshop Calculation and Science (Duration: - 20 hrs.)	Engineering Drawing (Duration: - 30 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 - Viewing of engineering drawing sheets. Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	Fractions: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Calculator.	Drawing Instruments : their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
3.	Properties of Material : properties - Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous Alloys.	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.	Average :Problems of Average. Ratio &Proportion : Simple calculation on related problems.	Drawing of Geometrical Figures: Drawing practice on: - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. Circle and its elements.
5.	Mass, Weight and Density: Mass, Unit of Mass, Weight, difference	Dimensioning: - Definition, types and methods of dimensioning (functional, non-

Mechanic Automobile (Advanced Petrol Engine)

	between mass and weight, Density, unit of density.	functional and auxiliary) - Types of arrowhead Leader Line with text
6.		<u>Free hand drawing of</u> - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches.
7.	<u>Percentage</u> : Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	<u>Method of presentation of Engineering Drawing</u> - Pictorial View - Orthogonal View Isometric view
8.	Forces definition. - Definition and example of compressive, tensile, shear forces, axial and tangential forces. Stress, strain, ultimate strength, factor of safety for MS. <u>Speed and Velocity</u> : Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	<u>Symbolic Representation (as per BIS SP:46-2003) of :</u> - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element Piping joints and fittings
9.	<u>Mensuration</u> : Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere. - Area of cut-out regular surfaces: circle and segment and sector of circle. - Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple solid blocks.	<u>Dimensioning practice:</u> - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) Symbols preceding the value of dimension and dimensional tolerance
10.	<u>Algebra</u> : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	<u>Construction of Geometrical Drawing Figures:</u> - Polygons and their values of included angles.

Mechanic Automobile (Advanced Petrol Engine)

	- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force.	Conic Sections (Ellipse)
11.	Work, Power and Energy: work, unit of work, power, unit of power, Horse power, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification. Drawing of Orthographic projection from isometric/3D view of blocks



Skill India
कौशल भारत - कुशल भारत

Mechanic Automobile (Advanced Petrol Engine)

Block – II		
Sl. No.	Workshop Calculation and Science (Duration: - 20 hrs.)	Engineering Drawing (Duration: - 30 hrs.)
12.	Trigonometry: Trigonometric ratios, Trigonometric tables. - Finding the value of unknown sides and angles of a triangle by Trigonometrical method. - Finding height and distance by trigonometry.	Machined components; concept of fillet & chamfer; surface finish symbols.
	Friction and its application in Workshop practice.	
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.	Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
14	Basic Electricity: Introduction, use of electricity, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing. Heat treatment – Necessity, different common types of Heat treatment. Graph: - Read images, graphs, diagrams – Bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	Reading & interpretation of assembly drawing and detailing.
15	Transmission of power: By belt, pulleys & gear drive.	Reading of drawing. Simple exercises related to missing lines, dimensions and views. How to make queries.
16	Concept of pressure – units of pressure, atmospheric pressure, gauge pressure – gauges used for measuring pressure. Introduction to pneumatics & hydraulics systems. Solution of NCVT test papers	Simple exercises related to trade related symbols. - Solution of NCVT test papers.

Mechanic Automobile (Advanced Petrol Engine)

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I (Duration – 55 hrs.)		
1. English Literacy		Duration : 20 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 know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
2. I.T. Literacy		Duration : 20 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.	

Mechanic Automobile (Advanced Petrol Engine)

Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	
	Duration : 15 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
Block – II	
Duration – 55 hrs.	
4. Entrepreneurship Skills	Duration : 15 Hrs. Marks : 06

Mechanic Automobile (Advanced Petrol Engine)

Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity	
Duration : 10 Hrs. Marks : 05	
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
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 : 15 Hrs. Marks : 06	
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic 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

Mechanic Automobile (Advanced Petrol Engine)

	measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & 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. Labour Welfare Legislation	
Duration : 05 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 : 10 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.

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE) TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Making components observing different metal removing procedure and perform different fitting job.
4. Assembling of different components as per requirement and check functionality.
5. Carryout maintenance of different machines including hydraulics & pneumatics system.

Note: Actual training will depend on the existing facilities available in the establishments.

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

BLOCK – I

1. Plan & perform basic fastening and fitting operations using various tools and equipments used in automotive workshop.
2. Trace and test simple electrical components and circuits and assemble to ensure functionality of system.
3. Diagnose and troubleshoot the cooling system faults, repair/replace the defective components and check functionality of system.
4. Diagnose and troubleshoot the lubricating system faults, repair/replace the defective components and check functionality of system.
5. Trace and test charging system circuits, service the charging system components and check for its functionality.
6. Trace and test starting system circuits, service the starting and ignition system components and check for its functionality.
7. Diagnose fuel system faults and repair/replace the components.
8. Overhaul and service the vehicle air conditioning system components and check functionality of system.

BLOCK – II

9. Diagnose petrol engine problems by carry out vacuum, compression and oil pressure tests and concluding the results.
10. Plan and overhaul petrol engine and check functionality and perform petrol engine tune up.

Mechanic Automobile (Advanced Petrol Engine)

11. Trace and test electronic components and circuits and assemble to ensure functionality of system.
12. Test functionality of multi point fuel injection components of petrol vehicle and repair/replace defective components.
13. Diagnose the problems with intake and exhaust system components and repair/replace the defective components.
14. Perform service and overhauling of transmission system and repair/replace defective components.
15. Diagnose automatic transmission wiring system problems, test and analyze test report for proper functioning.
16. Carry out overhauling of vehicle chassis system includes steering, suspension and braking system and check functionality.
17. Diagnose power steering system problems and service the components and check for its functionality.
18. Diagnose and trouble shoot Anti-Lock System problem of a vehicle.
19. Carry out removal, repair and assembling, wheel balancing activities of tyres and tubes of a vehicle.
20. Diagnose problems with vehicle comfort systems and test for its functionality.
21. Diagnose LPG system problems test the components and check its functionality.
22. Diagnose CNG system problems test the components and check its functionality.
23. Identify the components of electric and hybrid vehicle components.

Note:

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 16 Apprentices)			
A. Trainees tool kit			
Sl. no.	Name of the Tool & Equipments	Specification	Quantity
1	Allen Key set of 12 pieces	2mm to 14mm	(6+1)
2	Caliper inside	15 cm Spring type	7
3	Calipers outside	15 cm spring type	7
4	Center Punch	10 mm. Dia. x 100 mm.	7
5	Dividers	15 cm Spring type	7
6	Electrician Screw Driver	250mm	7
7	Hammer ball peen with handle	0.5 kg	7
8	Hands file Second cut flat	20 cm.	7
9	Philips Screw Driver set of 5 pieces	100 mm to 300 mm	7
10	Pliers combination	20 cm.	7
11	Screw driver	20cm.X 9mm. Blade	7
12	Screw driver	30 cm. X 9 mm. Blade	7
13	Scriber	15 cm	7
14	Spanner D.E. set of 12 pieces	6mm to 32mm	7
15	Spanner, ring set of 12 metric sizes	6 to 32 mm.	7
16	Spanners socket with speed handle, T-bar, ratchet and universal with box.	upto 30 cm inch and metric. 32 mm set of 28 pieces	7
17	Steel rule		7
18	Steel tool box with lock and key (folding type)	400x200x150 mm	7
19	Wire cutter and stripper		7
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
20	Adjustable spanner (pipe wrench)	350 mm	2
21	Air blow gun with standard accessories		1
22	Air impact wrench with standard accessories		4
23	Air ratchet with standard accessories		4
24	Allen Key set of 12 pieces	2mm to 14mm	4
25	Alternator assembly		2

Mechanic Automobile (Advanced Petrol Engine)

26	Ammeter 300A/ 60A DC with external shunt		4
27	Auto Electrical test bench		1
28	Battery charger		2
29	Belt Tensioner gauge		1
30	Caliper inside	15 cm Spring type	4
31	Calipers outside	15 cm spring type	4
32	Car Jet washer with standard accessories		1
33	Chisel flat	10 cm	4
34	Chisels cross cut	200 mm X 6mm	4
35	Circlip pliers Expanding and contracting type	15cm and 20cm each	4
36	Clamps C	100mm	2
37	Clamps C	150mm	2
38	Clamps C	200mm	2
39	Cleaning tray	45x30 cm.	4
40	Compression testing gauge suitable for diesel Engine with standard accessories		2
41	Connecting rod alignment fixture		1
42	Cylinder bore gauge capacity	20 to 160 mm	4
43	Cylinder liner- Dry & wet liner, press fit & slide fit liner		1 each
44	DC Ohmmeter	0 to 300 Ohms, mid scales at 20 Ohms	2
45	Depth micrometer	0-25mm	4
46	Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand)		4
47	Different type of Engine Bearing model		1 set
48	Different type of piston model		1each
49	Dividers	15 cm Spring type	4
50	Drift Punch Copper	15 Cm	4
51	Drill twist	1.5 mm to 15 mm (various sizes) by 0.5 mm	4
52	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
53	Electric tester		4
54	Engineer's square	15 cm. Blade	4
55	Engineers stethoscope		1
56	Executive Auto Electrical tool kit		1
57	Feeler gauge	20 blades (metric)	4

Mechanic Automobile (Advanced Petrol Engine)

58	File flat bastard	20 cm	4
59	File, half round second cut	20 cm	4
60	File, Square second cut	20 cm	4
61	File, Square round	30 cm	4
62	File, triangular second cut	15 cm	4
63	Files assorted sizes and types including safe edge file		2 set
64	Flat File second cut	25 cm	4
65	Flat File bastard	35 cm	4
66	Fuel feed pump for diesel		1
67	Fuel injection pump (Diesel) inline		1
68	Fuel injection pump dismantling tool kit /Universal Vice		1
69	Fuel injection pump, VE pump / Distributor fuel rotary pump (DPC) pumps / along with special tools and accessories.		1 each
70	Functional/experiment model of different type of sensors.		1 set
71	Gloves for Welding (Leather and Asbestos)		5 sets
72	Glow plug tester		2
73	Granite surface plate with stand and cover	1600 x 1000	1
74	Growler		2
75	Hacksaw frame adjustable	20-30 cm	10
76	Hammer Ball Peen	0.75 Kg	4
77	Hammer Chipping	0.25 Kg	5
78	Hammer copper with handle	1 Kg	4
79	Hammer Mallet		4
80	Hammer Plastic		4
81	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm		2
82	Hand reamers adjustable	10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	1 sets
83	Hand vice – 37 mm	100 cc both drum brakes	01 no
84	Hollow Punch set of seven pieces 6mm to 15mm	above 150 cc with disc and drum brakes and water cooled	01 no
85	Impact screw driver		01 no

Mechanic Automobile (Advanced Petrol Engine)

86	Injector – Multi hole type, Pintle type	100 cc	01 no
87	Injector cleaning unit		01 no
88	Injector tester (Hand tester)		01 no
89	Insulated Screw driver	20 cm x 9mm blade	01 no
90	Insulated Screw driver	30 cm x 9mm blade	01 no each
91	Magnifying glass	75mm	01 no
92	Marking out table	90X60X90 cm.	01 no
93	Multimeter digital		01 no
94	Oil can	0.5/0.25 liter capacity	01 no
95	Oil pump for dismantling and assembling.		01 no
96	Outside micrometer	0 to 25 mm	01 no
97	Outside micrometer	25 to 50 mm	01 no
98	Outside micrometer	50 to 75 mm	1
99	Outside micrometer	75 to 100 mm ,100 to 125 mm, 125 to 150 mm	1
100	Philips Screw Driver set of 5 pieces	100 mm to 300 mm	2
101	Piston ring compressor		2
102	Piston Ring expander and remover.		2
103	Piston Ring groove cleaner.		2
104	Pliers combination	20 cm.	2
105	Pliers flat nose	15 cm	2
106	Pliers round nose	15 cm	2
107	Pliers side cutting	15 cm	2
108	Portable electric drill Machine		1
109	Prick Punch	15 cm	4
110	Punch Letter	4mm (Number)	2 set
111	Radiator cut section-down flow		1
112	Radiator pressure cap		2
113	Scraper flat	25 cm	2
114	Scriber	15 cm	2
115	Scriber with scribing black universal		2
116	Spanner D.E.	set of 12 pieces (6mm to 32mm)	4
117	Spanner,	adjustable 15cm.	2
118	Spanner,	ring set of 12 metric sizes 6 to 32 mm.	4

Mechanic Automobile (Advanced Petrol Engine)

119	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box		2
120	Starter motor axial type, pre-engagement type & Co-axial type		1each
121	Steel measuring tape	10 meter in a case	4
122	Steel rule	15 cm inch and metric	4
123	Steel rule	30 cm inch and metric	4
124	Straight edge gauge	2 ft.	2
125	Straight edge gauge	4 ft.	2
126	Stud extractor	set of 3	2 sets
127	Stud remover with socket handle		1
128	Surface gauge	with dial test indicator plunger type i.e. 0.01 mm	4
129	Tachometer (Counting type)		1
130	Taps and Dies complete sets BSF		1 set
131	Taps and wrenches - metric		2 sets
132	Telescope gauge		4
133	Thermostat		2
134	Thread pitch gauge metric, BSW		2
135	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
136	Turbocharger cut sectional view		1
137	Universal puller for removing pulleys, bearings		1
138	V' Block	75 x 38 mm pair with Clamps	2
139	Vacuum gauge to read	0 to 760 mm of Hg.	2
140	Valve spring compressor universal.		1
141	Vernier caliper	0-300 mm with least count 0.02mm	4
142	Vice grip pliers		2
143	Wire Gauge (metric)		2
144	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	4
145	4 Point relays		2
146	5 Point relays		2
147	Vacuum pump gauge		1
148	Glow plug wrench		1

Mechanic Automobile (Advanced Petrol Engine)

149	Oil seal remover		1
150	Oil seal installer		1
151	Valve guide remover		1
152	Forceps		1
153	Fly wheel holder		1
154	Bearing puller		1
155	Bearing installer		1
156	Injection pump pulley remover		1
157	Cam shaft pulley holder		1
158	Cam shaft locking tool		1
159	Oil filter wrench socket		1
160	Oil pressure gauge		1
161	Radiator pressure tester		1
162	Fuel pressure gauge with adopters		1
C : GENERAL MACHINERY INSTALLATIONS			
163	Engine (Petrol) for dismantling and assembly		1
164	Transmission for assembly and disassembly training		1
165	Cut section of main parts and systems of vehicle for training		Each one
166	Drilling machine (general purpose)		1
167	Fuel and air induction equipment (cleaning/ decarbonising of fuel and air intake system)		1
168	Fuel Consumption Tester		1 No.
169	Methane Gas Leakage Detector		1 No.
170	Air compressor		1 No.
171	Two post lift		01
172	Wheel aligner		2 Nos
173	Wheel balancer		1 No.
174	Tyre changer		1 No.
175	Multi Scan Tool with oscilloscope		1 No.
176	Working Condition of Petrol Engine – MPFI - 4 stroke Engine Assembly with fault simulation board (vehicular model)		1 no.

**INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING
DRAWING**

TRADE: MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)

LIST OF TOOLS& EQUIPMENTS FOR -16APPRENTICES

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

2) **Infrastructure:**

A : TRAINEES TOOL KIT:-			
Sl. No.	Name of the items	Specification	Quantity
1.	Draughtsman drawing instrument box	As per standard	16
2.	Set square celluloid 45°	(250 X 1.5 mm)	16
3.	Set square celluloid 30°-60°	(250 X 1.5 mm)	16
4.	Mini drafter	As per standard	16
5.	Drawing board IS: 1444	(700mm x500 mm)	16
B : Furniture Required			
Sl. No.	Name of the items	Specification	Quantity
1	Drawing Board	As per standard	20
2	Models : Solid & cut section	As per standard	as required
3	Drawing Table for trainees	As per standard	as required
4	Stool for trainees	As per standard	as required
5	Cupboard (big)	As per standard	01
6	White Board	(size: 8ft. x 4ft.)	01
7	Trainer's Table	As per standard	01
8	Trainer's Chair	As per standard	01

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. 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	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.		

Skill India
कौशल भारत - कुशल भारत

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :						Year of Enrollment :								
Name & Address of ITI (Govt./Pvt.) :						Date of Assessment :								
Name & Address of the Industry :						Assessment location: Industry / ITI								
Trade Name :			Semester:			Duration of the Trade/course:								
Learning Outcome:														
Sl. No	Maximum Marks (Total 100 Marks)		15	5	10	5	10	10	5	10	15	15	Total internal assessment Marks	Result (Y/N)
	Candidate Name	Father's/Mother's Name	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA		
1														
2														