# CURRICULUM

# FOR THE TRADE OF

# MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)

# UNDER

# APPRENTICESHIP TRAINING SCHEME


## GOVERNMENT OF INDIA
## MINISTRY OF SKILL DEVELOPMENT& ENTREPRENURESHIP
## DIRECTORATE GENERAL OF TRAINING

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# 1. ACKNOWLEDGEMENT

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# 2. 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 22$^{nd}$ 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.

# 3. RATIONALE

## (Need for Apprenticeship in MECHANIC AUTOMOBILE

## (ADVANCED PETROL ENGINE) trade)

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

1. It offers a good synergy between BT (Theoretical Inputs) & PT (On the Job training) unlike earlier scheme where students need to complete two year's classroom training before undergoing PT (On The Job training).
2. It will enhance knowledge about scientific principles, familiarization with industrial culture, and basics of Automotive and its need.
3. It will enhance the ability to work with help of hand tools, power tools and machines. At the same time it creates the base for achieving hard skills.
4. It will enhance knowledge about different types of Engines, Diagnosis techniques and tools used in industries.
5. It will enhance the ability to work on conventional as well as latest engines and to service and trouble shoot Engine parts.
6. It will enhance knowledge about industrial terminology, industrial practices and revitalize previous learning.
7. It will enhance the ability of problem solving related to Petrol Engines.

# 4. JOB ROLES: REFERENCE NCO

## Brief description of Job roles:

On successful completion of the course the candidates can either get employed, or become a self-employed Entrepreneur in any one of the following fields.

**a) Wage Employment**

1. Auto Mechanic
2. Service Technician
3. Mechanic in Auto Manufacturing Industry
4. Dealers service mechanic
5. Driver/Vehicle Operator
6. Spare Parts Sales Assistant / Manufacturers' Representative
7. Automotive Laboratory Assistant

**b) Self Employment**

1. Automobile Mechanic
2. Vehicle Operator
3. Spare Parts Salesman
4. Spare Parts Dealer

Reference NCO: 7233.22

# 5. GENERAL INFORMATION

1. **Name of the Trade** : **MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)**

2. **N.C.O. Code No.** : 7233.22

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

3.1 **For Fresher :-**

**Duration of Basic Training**: -

a) Block –I : 3 months

b) Block – II : 3 months

**Total duration of Basic Training: 6 months**

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

a) Block–I: 9 months

b) Block–II : 9 months

**Total duration of Practical Training: 18 months**

3.2 **For ITI Passed :-**

**Duration of Basic Training**: - NIL

**Duration of Practical Training (On -job Training): 12 months**

6. **Entry Qualification** : 10th Passed

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

**8. Rebate allowed for Trainees :One year** for the trainees completed BroadBased Basic Training in Automobile Sector under Centre of Excellence Scheme and Advanced module of Centre of Excellence Scheme in Servicing and Overhauling of Automobiles (Petrol).

*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.*

# 6. COURSE STRUCTURE

**Training duration details: -**

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

**Duration of Training in Months**

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

# 7. SYLLABUS

## 7.1 BASIC TRAINING
## (BLOCK – I &II)
## DURATION: 06 MONTHS

### GENERAL INFORMATION

1) **Name of the Trade** :**MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 16 Nos.
4) **Power Norms** : 3.5 KW for Workshop
5) **Space Norms** : 88 Sq M
6) **Examination** : The internal assessment will beheld on completion of each Block.
7) **Instructor Qualification** :

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| Degree/Diploma in Mechanical / Automobile Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant field.<br>**OR**<br>NTC/NAC in the trade of Mechanic Motor Vehicle with three year post qualification experience in the relevant field.<br>Preference will be given to a candidate with Craft Instructor Certificate (CIC) |

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

## 7.1.1 DETAILSYLLABUS OF CORE SKILL

### A. Block– I
### Basic Training

| Topic No. | a) Engineering Drawing | Duration (in hours) | b) Workshop Science & Calculation | Duration (in hours) |
|---|---|---|---|---|
| 1 | **Engineering Drawing: Introduction and its importance**<br>- Viewing of engineering drawing sheets.<br>- Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 | **30** | **Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units | **20** |
| 2 | **Drawing Instruments : their uses**<br>Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips. | | **Fractions**: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Calculator. | |
| 3 | **Lines :**<br>- Definition, types and applications in Drawing as per BIS SP:46-2003<br>- Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)<br>- Drawing lines of given length (Straight, curved)<br>- Drawing of parallel lines, perpendicular line<br>Methods of Division of line segment | | **Properties of Material** : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous Alloys. | |
| 4 | **Drawing of Geometrical Figures:**Drawing practice on:<br>- Angle: Measurement and its types, method of bisecting.<br>- Triangle -different types<br>- Rectangle, Square, Rhombus, Parallelogram.<br>- Circle and its elements. | | **Average :** Problems of Average.<br>**Ratio &Proportion** : Simple calculation on related problems.<br>**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density. | |
| 5 | **Dimensioning:**<br>- Definition, types and methods of dimensioning (functional, non-functional and auxiliary)<br>- Types of arrowhead<br>- Leader Line with text | | | |
| 6 | **Free hand drawing of**<br>- Lines, polygons, ellipse, etc.<br>- geometrical figures and blocks with dimension | | | |

| | | | | |
|---|---|---|---|---|
| | - Transferring measurement from the given object to the free hand sketches. | | | |
| 7 | **Method of presentation of Engineering Drawing**<br>- Pictorial View<br>- Orthogonal View<br>- Isometric view | | **Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa. | |
| 8 | **Symbolic Representation (as per BIS SP:46-2003) of :**<br>- Fastener (Rivets, Bolts and Nuts)<br>- Bars and profile sections<br>- Weld, brazed and soldered joints.<br>- Electrical and electronics element<br>- Piping joints and fittings | | - Forces definition.<br>- Definition and example of compressive, tensile, shear forces, axial and tangential forces.<br>Stress, strain, ultimate strength, factor of safety for MS.<br>**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. | |
| 9 | **Dimensioning practice:**<br>- Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003)<br>- Symbols preceding the value of dimension and dimensional tolerance. | | **Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle.<br>Volume of solids – cube, cuboids, cylinder and Sphere.<br>Surface area of solids – cube, cuboids, cylinder and Sphere.<br>- Area of cut-out regular surfaces: circle and segment and sector of circle.<br><br>- Volume of cut-out solids: hollow cylinders, frustum of cone, block section.<br>- Volume of simple solid blocks. | |
| 10 | **Construction of Geometrical Drawing Figures:**<br>- Polygons and their values of included angles.<br>Conic Sections (Ellipse) | | **Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).<br>- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force. | |
| 11 | **Projections:**<br>- Concept of axes plane and quadrant.<br>- Orthographic projections<br>- Method of first angle and third angle projections (definition and difference)<br>- Symbol of 1st angle and 3rd angle projection as per IS specification.<br><br>Drawing of Orthographic projection from isometric/3D view of blocks | | **Work, Power and Energy**: work, unit of work, power, unit of power, Horse power, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. | |

## B. Block- II
## Basic Training

| Topic No. | a) Engineering Drawing | Duration (in hours) | b) Workshop Science & Calculation | Duration (in hours) |
|---|---|---|---|---|
| **1** | - Machined components; concept of fillet & chamfer; surface finish symbols. | **30** | **Trigonometry:** Trigonometric ratios, Trigonometric tables.<br>- Finding the value of unknown sides and angles of a triangle by Trigonometrical method.<br>- Finding height and distance by trigonometry. | **20** |
| | | | **Friction** and its application in Workshop practice. | |
| **2** | - Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS. | | **Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation. | |
| **3** | - Reading & interpretation of assembly drawing and detailing. | | **Basic Electricity**: Introduction, use of electricity, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing. | |
| | | | **Heat treatment** – Necessity, different common types of Heat treatment. | |
| | | | **Graph:**<br>- Read images, graphs, diagrams – bar chart, pie chart.<br>- Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities. | |
| **4** | - Reading of drawing. Simple exercises related to missing lines, dimensions and views.<br>How to make queries. | | **Transmission of power:** By belt, pulleys & gear drive. | |
| **5** | - Simple exercises related to trade related symbols.<br>- Solution of NCVT test papers. | | **Concept of pressure** – units of pressure, atmospheric pressure, gauge pressure – gauges used for measuring pressure.<br>**Introduction to pneumatics & hydraulics systems.**<br>Solution of NCVT test papers | |

## 7.1.2DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

### A. Block –I

### Basic Training (03 Month)

| Week NO | PROFESSIONAL SKILL (275 Hrs.) | PROFESSIONAL KNOWLEDGE(120 Hrs.) |
|---|---|---|
| 1 | GENERAL SHOP SAFETY<br><br>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<br><br>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 and dial gauge-description of surface plate and V blocks-importance of correct roundness-surface finish and its importance. |
| 3 | FASTENERS AND BEARINGS<br><br>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<br><br>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. |

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| 5 | BASIC WELDING AND PNEUMATICS<br><br>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<br><br>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<br><br>Vehicle. Demonstration of vehicle<br><br>specification data; Identification of vehicle information Number (VIN).<br><br>Demonstration of Garage, Service station equipment.- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks**,**<br><br>Stands.<br><br>General servicing - vehicles washing, cleaning, oiling, greasing and lubrication of vehicle. | Auto Industry - History, leading manufacturers, development in vehicle industry, trends, new product.<br><br>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.<br><br>Brief description and uses of Vehicle hoists<br><br>– Two post and four post hoist, Engine hoists, Jacks**,** Stands. |
| 8 | Identification of major components of engine and its accessories. | Introduction to Engine:<br>Description of internal & external combustion engines, Classification of IC |

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| | Different types of Starting and Stopping Methods of Engine. | engines, Principle & working of 2&4-stroke diesel engine (Compression ignition Engine (C.I)) &spark ignitionengine(S.I) , differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection.<br>Technical terms used in engine, Engine specification. |
| 9 | BATTERY<br><br>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.<br><br>LIGHTING SYSTEMS<br><br>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.<br><br>Description of Lighting system reading Instrument panel light. |
| 10 | STARTING SYSTEM<br><br>Remove and replace starter- check starting system wiring harness- test ignition switch- remove and replace starter relay..<br><br>CHARGING SYSTEM<br><br>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 stating system- Principle of starter- components of a starter- construction and working of starter- starter field coil design- solenoids- types and function.<br><br>Study about wiring diagram of a charging system- construction and working principle of alternator- description of voltage regulator operation.<br><br>Integrated Starter Generator. |
| 11 | COOLING AND LUBRICATING SYSTEM<br><br>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 | 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 |

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| | thermostat.<br><br>Drain engine oil- change oil filter- replace new engine oil- blotting paper test- remove and replace oil pump- remove, clean and replace oil cooler. | pump- construction and working- fan- rigid and variable drive- electrically driven fans- viscous coupling- types of thermostat and its description<br><br>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 |
| 12 | Identification of Air conditioning components.<br><br>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.<br><br>Understanding Periodic Service of Vehicle<br><br>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.<br><br>Use of Spare parts catalogue, workshop service manual price list, Procedure of Ordering items and spare parts & Billing.<br><br>Idea about PD Inspection. |

## B. Block –II
## Basic Training (03 Months)

| Week NO | PROFESSIONAL SKILL (275 Hrs.) | PROFESSIONAL KNOWLEDGE(120 Hrs.) |
|---|---|---|
| 1 | INTAKE AND EXHAUST SYSTEMS<br><br>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<br><br>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<br><br>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.<br><br>Set up for testing.<br><br>Identification of various EFI sensors installed in engine & its mounting. | 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 |

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| | 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.<br><br>Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes.<br><br>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.<br><br>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<br><br>Demonstration of Emission control methods.<br><br>Test and service an exhaust gas recirculating valve- remove and replace EGR valve- clean an EGR valve and passages. | Emission Control:- Vehicle emissions<br><br>Standards- Euro and Bhart II, III, IV, V Sources of emission, Combustion, Combustion chamber design.<br><br>Types of emissions: Characteristics and Effect.<br><br>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<br><br>Identification of Automatic transmission | Description, construction and function of Transmission system |

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| | components and related sensors.<br><br>Tracing wiring circuit in Automatic Transmission<br><br>Electronic Power Steering<br><br>Identification of EPS components and related sensors.<br><br>Tracing wiring circuit in EPS. | Automatic Transmissions - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches.<br><br>Planetary gearing<br><br>Electronic control transmission<br><br>Continuously variable transmission (C.V.T.)-.<br><br>Description, construction and function of steering system their movement<br><br>Description of Electric power assisted steering, Basic electric power steering operation, |
| 8 | ABS<br><br>Identification of ABS components and related sensors.<br><br>Tracing wiring circuit in Antilock Braking system | Description, construction and function of Braking system.<br><br>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.<br><br>Removing rear axle assembly from vehicle, dismantling, cleaning, and refitting.<br><br>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.<br><br>Care and maintenance constant velocity joints special and advantages.<br><br>Description and purpose of different types of rear axles, Multi axle, special features and advantages in each type lubrication of axles, Underslung, over slung & Transaxle.<br><br>Description & functions of final drive assembly crown wheel and tail pinion hypoid gear, Bevel<br><br>type and worm & worm wheel and its lubrication |

| | | |
|---|---|---|
| | | Descriptions of differential and its principle of<br>operation. Common troubles and their remedy<br>in rear axle assembly.<br>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 hushes in shock absorbers, cleaning & lubrication of wheel bearings, adjusting<br><br>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.<br>Working, construction of suspension system, Independent and conventional suspension system, torsion bar stabilizer bar, struls, bushes<br>Air Suspension its parts, function advantages over conventional system. |
| 11 | Demonstration on Safety and precautions while working with LPG and CNG.<br>Identification of LPG System components<br>Identification of CNG System components | Popular Automotive Fuels & Alternate Fuels,<br>What is LPG, benefits of LPG, System layout of LPG & system, Major components and their functions - Filler valves, LPG cylinder, LPG high pressure filter, Vaporizer, Gas injector rail, Select switch cum level indicator, Circuit diagram, LPG malfunctioning light, Periodic maintenance schedule, Safety Precautions - Do's & Don'ts<br>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,<br>Coolant supply, CNG / LPG Leak detector, Working on CNG line.<br>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<br><br>Identify antitheft system.<br><br>Practice on Identifying Proximity sensor, Parking sensor, crash sensor, Rain and Light sensor<br><br>Identification of Air bag components<br><br>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.<br><br>Integrated communications, Proximity sensors, Reflective displays, and Global positioning satellites.<br><br>Introduction, function and advantages of parking sensor, crash sensor, Rain and Light sensor, Car immobilizer system, Electric Sunroof.<br><br>Description of OBD<br><br>Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes.<br><br>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. |
| | Assessment | |

# 7.1.3 EMPLOYABILITY SKILLS

## GENERAL INFORMATION

| | | | |
|---|---|---|---|
| 1) | **Name of the subject** | **:** | **EMPLOYABILITY SKILLS** |
| 2) | **Applicability** | **:** | ATS- Mandatory for fresher only |
| 3) | **Hours of Instruction** | **:** | **110 Hrs. (55 hrs. in each block)** |
| 4) | **Examination** | **:** | The examination will be held at the end of two years Training by NCVT. |
| 5) | **Instructor Qualification** | **:** | |

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

**And**

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

**OR**

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

## 7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

### A. Block – I
### Basic Training

| Topic No. | Topic | Duration (in hours) |
|---|---|---|
| | **English Literacy** | |
| 1 | **Pronunciation :**<br>Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech) | **15** |
| 2 | **Functional Grammar**<br>Transformation of sentences, Voice change, Change of tense, Spellings. | |
| 3 | **Reading**<br>Reading and understanding simple sentences about self, work and environment | |
| 4 | **Writing**<br>Construction of simple sentences Writing simple English | |
| 5 | **Speaking / Spoken English**<br>Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication. | |
| | **I.T. Literacy** | |
| 1 | **Basics of Computer**<br>Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer. | **15** |
| 2 | **Computer Operating System**<br>Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications. | |
| 3 | **Word processing and Worksheet**<br>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.<br>Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets | |
| 4 | **Computer Networking and INTERNET**<br>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),<br>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.<br>Information Security and antivirus tools, Do's and Don'ts in<br>Information Security, Awareness of IT - ACT, types of cyber crimes. | |

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

## B. Block–II
## Basic Training

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

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

## 7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
## (BLOCK – I&II)
## DURATION: 18 MONTHS (9 months in each block)

## GENERAL INFORMATION

1) **Name of the Trade** :**MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)**

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

3) **Batch size** : 16 Nos.

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

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

5) **Instructor Qualification** :

**i)** Degree/Diploma in Mechanical / Automobile Engg. from recognized university/Board with one/two year post qualification experience in the relevant field.

**OR**

NTC/NAC in the trade of Mechanic Motor Vehicle with three year post qualification experience in the relevant field.

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

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

## 7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

### A. BLOCK – I (09 Month)

1) MEASURING PRACTICE – taper measurement of the given job and flatness of the given job
2) Practice on Hacksawing and filing to given dimensions.
3) Practice on Marking and Drilling clear and Blind Holes
4) Construction of simple electrical circuits
5) Diagnose series, parallel, series parallel circuits using Ohm's law,
6) Check electrical circuit with a test lamp.
7) Use of service manual wiring diagram for troubleshooting.
8) Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.
9) Perform engine vacuum test, engine compression and engine oil pressure test, interpret and conclude the results
10) SERVICE COOLING SYSTEM-
    a. perform cooling system pressure tests, inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action
    b. inspect, replace and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment
    c. inspect, test, and replace thermostat
    d. inspect and test fan (electrical)
11) SERVICE LUBRICATING SYSTEM- change engine oil and filter, flush lubricating system, Service oil pump
12) Perform a battery load test
13) Perform jump start an engine with jumper cables
14) Maintenance of Battery
15) Inspect, test and diagnose starting system
16) Inspect, test and diagnose charging system
17) Test alternator in an auto electrical test bench
18) Test starter in an auto electrical test bench
19) Diagnose instrument panel board warning light problems
20) Performance test on A/c unit.
21) Insufficient cooling, Troubleshoot Abnormal noise from Magnetic clutch, Blower motor. Condenser Fan.

## B. BLOCK – II (09 Months)

1. DIAGNOSE ENGINE PROBLEMS
    a. perform engine vacuum test, engine compression and engine oil pressure test, interpret and conclude the results

2. OVERHAULING OF CYLINDER HEAD ASSEMBLY
   DISMANTLE, CLEAN, INSPECT, MEASURE, CONCLUDE THE RESULTS, DETERMINE FOR REPLACE THE COMPONENTS AND REASSEMBLE CYLINDER HEAD ASSEMBLY.
    a. dismantle engine head assembly
    b. visual inspection of components for cracks
    c. check gasket surface areas for warpage and surface finish
    d. inspect and measure valves, valve seats and valve spring
    e. replace valve seats and valves
    f. valve lapping
    g. replace valve guide, check valve stem- to- guide clearance
    h. reaming valve guide for correct clearance
    i. inspect and measure rocker assembly, determine necessary action
    j. inspect and measure cam shaft run out, journal and cam lobe wear
    k. inspect valve lifters
    l. inspect and replace drive belt/chain
    m. reassemble engine head assembly

3. OVERHAULING OF CYLINDER BLOCK ASSEMBLY
   DISMANTLE, CLEAN, INSPECT, MEASURE, CONCLUDE THE RESULTS, DETERMINE FOR REPLACE THE COMPONENTS AND REASSEMBLE CYLINDER BLOCK ASSEMBLY.
    a. dismantle engine block assembly
    b. inspect engine block for visible cracks and surface warpage
    c. inspect and measure cylinder walls/sleeves for damage, wear and ridges
    d. inspect and measure crank shaft for journal wear
    e. inspect and measure main and connecting rod bearings for wear
    f. determine piston to bore clearance
    g. inspect, measure and install piston rings
    h. service oil pump, measure oil pump components
    i. reassemble engine block components
    j. adjust valve clearance

4. ECU
    a. Diagnose engine electronic problems with scan tool
    b. Diagnose sensor problems
    c. Troubleshoot vehicle with the help of Diagnostic Tool (DT) - DT and Diagnostic Trouble Code (DTC)
    d. Trouble shooting for lost communication

5. SERVICE FUEL FEED SYSTEM
    a. Clean fuel tank
    b. Service low pressure pump
    c. Service fuel filter
    d. Trouble shooting in MPFI wiring circuit
    e. Testing of MPFI components and replacement if necessary.

6. EXHAUST SYSTEM
    a. Inspect and test an exhaust system
    b. Test and service a catalytic converter
    c. Perform a shaft balancing test of a turbo charger

7. TRANSMISSION & STEERING SYSTEM
    1. Diagnose AT system wiring circuits
    2. Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler
    3. Inspection of power steering control module circuit. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system.
    4. Trouble shooting and remedy for steering wheel feels heavy at low speed, poor recovery from turns.

8. Diagnosis ABS problems
9. Removing rear axle assembly from vehicle, dismantling, cleaning, inspecting parts for wear and damage, cutting packings/gaskets removing tail pinion and bearings cleaning and inspection of oilseals and bearings.
10. Checking tooth contact in crown land pinion and adjusting back-lash-assembling the rear axle assembly on vehicles and testing.
11. Inspection and overhaul front & rear suspension rear springs, coil spring torsion bars, check up main axle for alignment.
12. Inspection the frame checking alignment of frame servicing of spring replacing new bushes in shackle pins changing hushes in shock absorbers
13. Rotating the wheels in vehicle minor repairs to wheels and tyres,
14. Wheel balancing & alignment.
15. Troubleshooting of Liquid Petroleum Gas (LPG) system and Parameters of Liquid Petroleum Gas fuel system in diagnostic tool.
16. Diagnosing CNG System and its Component.
17. Diagnosis of car radio wiring and speaker circuits problem
18. Diagnose seat belt systems wiring system.
19. Diagnose air bag system wiring circuits and service warnings.
**20.** Identify various componentsof Electric and Hybrid vehicles.

# 8. ASSESSMENT STANDARD

## 8.1 Assessment Guideline:

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

The following marking pattern to be adopted while assessing:

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

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

In this work there is evidence of:

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

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

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

In this work there is evidence of:

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

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

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

## 7.2FINAL ASSESSMENT- ALL INDIA TRADE TEST

| SUBJECTS | Marks | Internal assessment based on competency | Full Marks | Pass Marks | Duration of Exam. |
|---|---|---|---|---|---|
| Professional Skill | 300 | 100 | 400 | 240 | **08 hrs.** |
| Professional Knowledge | 100 | 20 | 120 | 48 | 3 hrs. |
| Workshop Cal. & Sc. | 50 | 10 | 60 | 24 | 3 hrs. |
| Engineering Drawing | 50 | 20 | 70 | 28 | 4 hrs. |
| Employability Skill | 50 | -- | 50 | 17 | 2 hrs. |
| **Grand Total** | **550** | **150** | **700** | -- | |

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

# 9. FURTHER LEARNING PATHWAYS

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

**Employment opportunities:**

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

1. Automobile and allied industries
2. Service industries like road transportation and Railways.
3. Self employment

**ANNEXURE – I**

# TOOLS & EQUIPMENT FOR BASIC TRAINING

## INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

## TRADE:MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)

## LIST OF TOOLS & EQUIPMENTS FOR 16APPRENTICES

## A : TRAINEES TOOL KIT:-

| Sl. No. | Item with specification | Qty (Nos.) |
|---|---|---|
| 1. | Allen Key set of 12 pieces (2mm to 14mm) | (6+1) |
| 2. | Caliper inside 15 cm Spring | 7 |
| 3. | Calipers outside 15 cm spring | 7 |
| 4. | Center Punch 10 mm. Dia. x 100 mm. | 7 |
| 5. | Dividers 15 cm Spring | 7 |
| 6. | Electrician Screw Driver 250mm | 7 |
| 7. | Hammer ball peen 0.5 kg with handle | 7 |
| 8. | Hands file 20 cm. Second cut flat | 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 upto 32 mm set of 28 pieces with box. | 7 |
| 17. | Steel rule 30 cm inch and metric. | 7 |
| 18. | Steel tool box with lock and key (folding type) 400x200x150 mm | 7 |
| 19. | Wire cutter and stripper | 7 |
| | | |

## B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

| Sl. No. | Item with specification | Qty (Nos.) |
|---|---|---|
| 1. | Adjustable spanner (pipe wrench 350 mm) | 2 |
| 2. | Air blow gun with standard accessories | 1 |
| 3. | Air impact wrench with standard accessories | 4 |
| 4. | Air ratchet with standard accessories | 4 |
| 5. | Allen Key set of 12 pieces (2mm to 14mm) | 4 |
| 6. | Alternator assembly | 2 |
| 7. | Ammeter 300A/ 60A DC with external shunt | 4 |
| 8. | Auto Electrical test bench | 1 |
| 9. | Battery –charger | 2 |
| 10. | Belt Tensioner gauge | 1 |
| 11. | Caliper inside 15 cm Spring | 4 |
| 12. | Calipers outside 15 cm spring | 4 |
| 13. | Car Jet washer with standard accessories | 1 |
| 14. | Chisel 10 cm flat | 4 |
| 15. | Chisels cross cut 200 mm X 6mm | 4 |
| 16. | Circlip pliers Expanding and contracting type 15cm and 20cm each | 4 |
| 17. | Clamps C 100mm | 2 |
| 18. | Clamps C 150mm | 2 |
| 19. | Clamps C 200mm | 2 |
| 20. | Cleaning tray 45x30 cm. | 4 |
| 21. | Compression testing gauge suitable for diesel Engine with standard accessories | 2 |
| 22. | Connecting rod alignment fixture | 1 |
| 23. | Cylinder bore gauge capacity 20 to 160 mm | 4 |
| 24. | Cylinder liner- Dry & wet liner, press fit & slide fit liner | 1 each |
| 25. | DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms | 2 |
| 26. | Depth micrometer 0-25mm | 4 |
| 27. | Dial gauge type 1 Gr. A (complete with clamping devices and with magnetic stand) | 4 |
| 28. | Different type of Engine Bearing model | 1 set |
| 29. | Different type of piston model | 1each |
| 30. | Dividers 15 cm Spring | 4 |
| 31. | Drift Punch Copper 15 Cm | 4 |
| 32. | Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm | 4 |
| 33. | Electric Soldering Iron 230 V 60 watts 230 V 25 watts | 2 each |
| 34. | Electric tester | 4 |
| 35. | Engineer’s square 15 cm. Blade | 4 |
| 36. | Engineers stethoscope | 1 |
| 37. | Executive Auto Electrical tool kit | 1 |
| 38. | Feeler gauge 20 blades (metric) | 4 |
| 39. | File flat 20 cm bastard | 4 |

| | | |
|---|---|---|
| 40. | File, half round 20 cm second cut | 4 |
| 41. | File, Square 20 cm second cut | 4 |
| 42. | File, Square 30 cm round | 4 |
| 43. | File, triangular 15 cm second cut | 4 |
| 44. | Files assorted sizes and types including safe edge file | 2 set |
| 45. | Flat File 25 cm second cut | 4 |
| 46. | Flat File 35 cm bastard | 4 |
| 47. | Fuel feed pump for diesel | 1 |
| 48. | Fuel injection pump (Diesel) inline | 1 |
| 49. | Fuel injection pump dismantling tool kit /Universal Vice | 1 |
| 50. | Fuel injection pump, VE pump / Distributor fuel rotary pump (DPC) pumps / along with special tools and accessories. | 1 each |
| 51. | Functional/experiment model of different type of sensors. | 1 set |
| 52. | Gloves for Welding (Leather and Asbestos) | 5 sets |
| 53. | Glow plug tester | 2 |
| 54. | Granite surface plate 1600 x 1000 with stand and cover | 1 |
| 55. | Growler | 2 |
| 56. | Hacksaw frame adjustable 20-30 cm | 10 |
| 57. | Hammer Ball Peen 0.75 Kg | 4 |
| 58. | Hammer Chipping 0.25 Kg | 5 |
| 59. | Hammer copper 1 Kg with handle | 4 |
| 60. | Hammer Mallet | 4 |
| 61. | Hammer Plastic | 4 |
| 62. | Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm | 2 |
| 63. | 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 |
| 64. | Hand vice – 37 mm | 2 |
| 65. | Hollow Punch set of seven pieces 6mm to 15mm | 2 sets each |
| 66. | Impact screw driver | 2 |
| 67. | Injector – Multi hole type, Pintle type | 4 each |
| 68. | Injector cleaning unit | 1 |
| 69. | Injector tester (Hand tester) | 1 |
| 70. | Insulated Screw driver 20 cm x 9mm blade | 4 |
| 71. | Insulated Screw driver 30 cm x 9mm blade | 4 |
| 72. | Magnifying glass 75mm | 2 |
| 73. | Marking out table 90X60X90 cm. | 1 |
| 74. | Multimeter digital | 5 |
| 75. | Oil can 0.5/0.25 liter capacity | 4 |
| 76. | Oil pump for dismantling and assembling. | 2 |
| 77. | Outside micrometer 0 to 25 mm | 4 |
| 78. | Outside micrometer 25 to 50 mm | 4 |
| 79. | Outside micrometer 50 to 75 mm | 1 |
| 80. | Outside micrometer 75 to 100 mm ,100 to 125 mm, 125 to 150 mm | 1 |

| | | |
|---|---|---|
| 81. | Philips Screw Driver set of 5 pieces (100 mm to 300 mm) | 2 |
| 82. | Piston ring compressor | 2 |
| 83. | Piston Ring expander and remover. | 2 |
| 84. | Piston Ring groove cleaner. | 2 |
| 85. | Pliers combination 20 cm. | 2 |
| 86. | Pliers flat nose 15 cm | 2 |
| 87. | Pliers round nose 15 cm | 2 |
| 88. | Pliers side cutting 15 cm | 2 |
| 89. | Portable electric drill Machine | 1 |
| 90. | Prick Punch 15 cm | 4 |
| 91. | Punch Letter 4mm (Number) | 2 set |
| 92. | Radiator cut section-down flow | 1 |
| 93. | Radiator pressure cap | 2 |
| 94. | Scraper flat 25 cm | 2 |
| 95. | Scriber 15 cm | 2 |
| 96. | Scriber with scribing black universal | 2 |
| 97. | Spanner D.E. set of 12 pieces (6mm to 32mm) | 4 |
| 98. | Spanner, adjustable 15cm. | 2 |
| 99. | Spanner, ring set of 12 metric sizes 6 to 32 mm. | 4 |
| 100. | Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box | 2 |
| 101. | Starter motor axial type, pre-engagement type & Co-axial type | 1each |
| 102. | Steel measuring tape 10 meter in a case | 4 |
| 103. | Steel rule 15 cm inch and metric | 4 |
| 104. | Steel rule 30 cm inch and metric | 4 |
| 105. | Straight edge gauge 2 ft. | 2 |
| 106. | Straight edge gauge 4 ft. | 2 |
| 107. | Stud extractor set of 3 | 2 sets |
| 108. | Stud remover with socket handle | 1 |
| 109. | Surface gauge with dial test indicator plunger type i.e. 0.01 mm | 4 |
| 110. | Tachometer (Counting type) | 1 |
| 111. | Taps and Dies complete sets BSF | 1 set |
| 112. | Taps and wrenches - metric | 2 sets |
| 113. | Telescope gauge | 4 |
| 114. | Thermostat | 2 |
| 115. | Thread pitch gauge metric, BSW | 2 |
| 116. | Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm | 1 each |
| 117. | Turbocharger cut sectional view | 1 |
| 118. | Universal puller for removing pulleys, bearings | 1 |
| 119. | V’ Block 75 x 38 mm pair with Clamps | 2 |
| 120. | Vacuum gauge to read 0 to 760 mm of Hg. | 2 |
| 121. | Valve spring compressor universal. | 1 |
| 122. | Vernier caliper 0-300 mm with least count 0.02mm | 4 |

| | | |
|---|---|---|
| 123. | Vice grip pliers | 2 |
| 124. | Wire Gauge (metric) | 2 |
| 125. | Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw | 4 |
| 126. | 4 Point relays | 2 |
| 127. | 5 Point relays | 2 |
| 128. | Vacuum pump gauge | 1 |
| 129. | Glow plug wrench | 1 |
| 130. | Oil seal remover | 1 |
| 131. | Oil seal installer | 1 |
| 132. | Valve guide remover | 1 |
| 133. | Forceps | 1 |
| 134. | Fly wheel holder | 1 |
| 135. | Bearing puller | 1 |
| 136. | Bearing installer | 1 |
| 137. | Injection pump pulley remover | 1 |
| 138. | Cam shaft pulley holder | 1 |
| 139. | Cam shaft locking tool | 1 |
| 140. | Oil filter wrench socket | 1 |
| 141. | Oil pressure gauge | 1 |
| 142. | Radiator pressure tester | 1 |
| 143. | Fuel pressure gauge with adopters | 1 |

## C : GENERAL MACHINERY INSTALLATIONS:-

| Sl. No. | Item with specification | Qty (Nos.) |
|---|---|---|
| 1 | Engine ( Petrol ) for dismantling and assembly | 1 |
| 2 | Transmission for assembly and disassembly training | 1 |
| 3. | Cut section of main parts and systems of vehicle for training | Each one |
| 4. | Drilling machine (general purpose) | 1 |
| 5. | Fuel and air induction equipment<br>(cleaning/ decarbonising of fuel and air intake system) | 1 |
| 6. | Fuel Consumption Tester | 1 No. |
| 7. | Methane Gas Leakage Detector | 1 No. |
| 8. | Air compressor | 1 No. |
| 9. | Two post lift | 01 |
| 10. | Wheel aligner | 2 Nos |
| 11. | Wheel balancer | 1 No. |
| 12. | Tyre changer | 1 No. |
| 13. | Multi Scan Tool with oscilloscope | 1 No. |
| 14. | Working Condition of Petrol Engine – MPFI - 4 stroke Engine Assembly with fault simulation board (vehicular model) | 1 no. |

**Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.**

# INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

## TRADE: MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)

## LIST OF TOOLS& EQUIPMENTS FOR 16 APPRENTICES

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

**2) Infrastructure:**

**A : TRAINEES TOOL KIT:-**

| Sl. No. | Name of the items | Quantity (indicative) |
|---|---|---|
| 1. | Draughtsman drawing instrument box | 16 |
| 2. | Set square celluloid $45^0$ (250 X 1.5 mm) | 16 |
| 3. | Set square celluloid $30^0$-$60^0$ (250 X 1.5 mm) | 16 |
| 4. | Mini drafter | 16 |
| 5. | Drawing board (700mm x500 mm) IS: 1444 | 16 |

**B : FURNITURE REQUIRED**

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

**ANNEXURE – II**

## TOOLS & EQUIPMENT FOR ON-JOB TRAINING

## INFRASTRUCTURE FOR PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

## TRADE: MECHANIC AUTOMOBILE (ADVANCED PETROL ENGINE)

## For Batch of 16 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

**ANNEXURE-III**

## GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

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

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

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

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