CURRICULUM

FOR THE TRADE OF

MECHANIC AUTO ELECTRICAL & ELECTRONICS

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

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 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.

RATIONALE

(Need for Apprenticeship in Mechanic Auto Electrical & Electronics 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 AutomotiveElectrical & Electronics 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 Electrical and Electronics components of vehicle, Diagnosis techniques and tools used in industries.
5. It will enhance the ability to work on conventional as well as latest electronic parts viz. ECU, Sensors etc.
6. It will enhance knowledge about industrial terminology, industrial practices and revitalize previous learning.

3. 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 Electrician
2. Spare Parts Sales Assistant / Manufacturers'Representative
3. Laboratory Assistant
4. Diagnostic Mechanic
5. Car AC Mechanic

b) Self Employment

1. Diagnostic Mechanic
2. Spare Parts Salesman
3. Spare Parts Dealer

Reference NCO: 7241.70, 7241.10

4. GENERAL INFORMATION

1. **Name of the Trade** : **MECHANIC AUTO ELECTRICAL & ELECTRONICS**

2. **N.C.O. Code No.** : 7241.70, 7241.10

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 Apprenticeship Act amended time to time.

8. Rebate to ITI Passed out Trainees :one year for the trade of **MECHANIC AUTO ELECTRICAL &ELECTRONICS**

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.

5. 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																								

6. SYLLABUS

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

GENERAL INFORMATION

1) **Name of the Trade** :**MECHANIC AUTO ELECTRICAL & ELECTRONICS**

2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)

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

4) **Power Norms** : 3 KW for Workshop

5) **Space Norms** : 100Sq.m.

6) **Examination** : The internal assessment will beheld on completion of each Block.

7) **Instructor Qualification** :

Degree/Diploma in Mechanical /Automobile Engg./Electrical /Electronic from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

NTC/NAC in the trade of MechanicAuto Electrical & Electronics with three year post qualification experience in the relevant field.
Preference will be given to a candidate with Craft Instructor Certificate (CIC)

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

7.1.1 DETAIL SYLLABUS 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** - Viewing of engineering drawing sheets. - 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** 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:** - 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		**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: - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.		**Average :** Problems of Average. **Ratio & Proportion** : Simple calculation on related problems. **Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density.	
5	**Dimensioning:** - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text			
6	**Free hand drawing of** - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension			

	- Transferring measurement from the given object to the free hand sketches.			
7	**Method of presentation of Engineering Drawing** - Pictorial View - Orthogonal View - 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 :** - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings		- Forces definition. - Definition and example of compressive, tensile, shear forces, axial and tangential forces. Stress, strain, ultimate strength, factor of safety for MS. **Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	
9	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance.		**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere. - 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.	
10	**Construction of Geometrical Drawing Figures:** - Polygons and their values of included angles. Conic Sections (Ellipse)		**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). - Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force.	
11	**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		**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. - Finding the value of unknown sides and angles of a triangle by Trigonometrical method. - 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: - Read images, graphs, diagrams – bar chart, pie chart. - 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. How to make queries.		**Transmission of power:** By belt, pulleys & gear drive.	
5	- Simple exercises related to trade related symbols. - Solution of NCVT test papers.		**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	

7.1.2DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week	PROFESSIONAL SKILL (275 Hours)	PROFESSIONAL KNOWLEDGE (120 Hour)
1	ADMISSION AND ORIENTATION OF THE COURSE Admission formalities and orientation of the course GENERAL SHOP SAFETY First aid and Fire safety, Use of fire extinguishers. 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.	**Admission & introduction to the trade:** Introduction to the Course duration, course content, study of the syllabus. **Occupational Safety & Health** Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Electrical safety tips.
2	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.	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 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 electrical, fuels, hand and power tools.
3	FASTENERS Practice on loosening and tightening of various screws, nuts and bolts using tools.	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.
4	BASIC HYDRAULICS & PNEUMATICS Exercise on using impact wrenches and blow gun- Practice on starting and stopping of work shop equipments. Practice on Garage& Service station equipments.-Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.	Description of air compressors, impact wrenches and blow gun- safety precautions to be observed while working with pneumatics. Brief description and uses of Vehicle hoists – Two posts and four post hoist, Engine hoists, Jacks, Stands.

5-6	BASIC ELECTRICAL Identify and interpret electrical 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 Brazing wires. Practice on testing fuses and relays	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 solenoids - description of multimeter- function and types of relays- semiconductors. Description of Soldering and brazing equipments.
7	BASIC ELECTRONICS Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality, Test diodes Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches.	Semiconductors- N type AND P type semiconductors- description of diodes and transistors.
8-9	Identification of major components of Automotive assembly and its accessories. Different type of starting and stopping of Engine. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition.	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 ignitionengine**(S.I) ,** differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Technical terms used in engine, Engine specification. Introduction to Transmission, control system and lighting system of Automotive vehicle. Study of various gauges/instrument on a dash board of a vehicle
10	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. Checking battery for defects.	Purpose of battery- types- construction and working principle of a lead acid battery- maintenance free batteries- battery ratings- battery charging methods- trouble shooting a battery. Description of IBS

11-12	Trace the light circuit - test bulbs, align head lamps, Aiming headlights. Changing a headlight bulb, Checking of a head light switch and to replace if faulty. Trace the wiring circuit of lighting system. Remove and install wiper motors and wiper switches. Remove and install new horn. Remove and Install Power door lock circuit	Lighting system, Lamps/light bulbs (Halogen, Xenon and LED), Lamp/light bulb information, LED lighting,. Headlight & dimmer circuits, Park & tail light circuits, Brake light circuits, turn signal circuit, Cornering lights, Fog lights circuit, interior lights- courtesy, reading and instrument panel lights, Smart lighting , Reverse lightsTemperature monitoring thermostat. Air-conditioning ECU, Blower speed control, Ventilation systems. Accessories: Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door lock circuit.
13	ASSESMENT/EXAM- 3 DAYS	

B. Block –II
Basic Training

Week	PROFESSIONAL SKILL (275 Hours)	PROFESSIONAL KNOWLEDGE(120 Hour)
1	STARTING SYSTEM Remove and replace starter- check starting system wiring harness- test ignition switch- remove and replace starter relay- dismantle and assemble starter.	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- trouble shooting a starting system.
2	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 charging system- construction and working principle of alternator- description of voltage regulator operation.
3	Identification and checking ignition system Practice on checking spark plug, spark plug gap, spark plug cleaning. Inspecting & adjusting an engine drive belt,	Ignition principles and Faraday's laws, Primary and secondary winding of transformer, Ignition components, Spark plugs, Spark plug components, Vacuum & centrifugal units, Plug firing voltage, Induction, Inductive system operation, Induction wiring, Hall effect sensors, Hall effect operation, Optical type sensors Distributor less ignition systems, Insulated coils, Distributor less ignition system timing Charging system- The purpose of Charging system, charging system components, charging system circuit, Alternator principles, Alternating current, Alternator components, Rectification, Phase winding connections, Rotor circuit, Voltage regulation, System operating voltage, High voltage charging systems, Rotor, Stator, Alternator end frames, Slip ring & brush assembly, Rectifier assembly, Alternator cooling fan.
4	Identification of Electronic control Unit. Set up for testing.	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

	Identification of various sensors installed in engine & its mounting.	monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram Electronic control unit (ECU) - EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp. Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes. EFI sensors- Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor.
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 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	CRDI SYSTEM disconnect and connect fuel supply hoses- relief fuel pressure- check fuel leakage- remove and install high pressure pipe line- remove and install fuel injector- remove and replace high pressure fuel pump- flush fuel tank- remove, test and replace fuel pump- replace fuel filter- remove and replace fuel injector.	Common rail direct injection system – need, advantages- layout of common rail direct injection system- low pressure and high pressure circuits- components of CRDI system- working principle of common rail direct injection system.
7	ABS Identification of ABS components and related sensors.	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

	Tracing wiring circuit in Antilock Braking system	Distribution (EBD) control unit.
8-9	Automatic transmission Identification of Automatic transmission components and related sensors. Tracing wiring circuit in Automatic Transmission Electronic Power Steering Identification of EPS components and related sensors. 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. Planetary gearing Electronic control transmission Continuously variable transmission (C.V.T.)-. Description of Electric power assisted steering, Basic electric power steering operation,
10	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, Global positioning satellites, Triangulation/trilateration, Telemetric. Networking & multiplexing Introduction, function and advantages of parking sensor, crash sensor, Rain and Light sensor, Car immobilizer system Electric Sunroof. ECU Communications- Communication between different ECUs. LIN Bus, MOST Bus, CAN Bus.
11	EMISSION CONTROL SYSTEM Test and service an exhaust gas recirculating valve- remove and replace EGR valve- clean an EGR valve and passages.	Details of air pollution and emissions- emission standards- description of smoke meter- types and description- exhaust gas recirculation system design and operation.
12& 13	Identification of Air conditioning components. Practice on adjustment of A/C inside the	Heating Ventilation Air Conditioning (HVAC) Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning

	cabin.	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. Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems.
ASSESMENT / EXAM- 03 days.		

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 :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	15
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**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.	
	I.T. Literacy	
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	15
2	**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.	
3	**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	
4	**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.	

Communication Skill		
1	**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. Case study/Exercise	**25**
2	**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.	
3	**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. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** Organizational Behavior Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

B. Block–II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**10**
1	**Concept of Entrepreneurship** **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** 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** 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** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**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.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**10**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	
2	**Occupational Hazards** 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** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	

4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision legislation of India. of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**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.	
	Quality Tools	**5**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**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.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	
	Leadership and Team Building skills.	**5**
1	Leadership Discipline and Morale Team Work Case Study/ Exercise	
2	**Meet the Mentor** **Role - play as a Supervisor**	**5**
	Organizing and Planning.	**5**
1	Time Management Group Dynamics 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 AUTO ELECTRICAL & ELECTRONICS**

2) **Duration of On-Job Training** : As per Apprenticeship 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/Electrical /ElectronicsEngg. from recognized university/Board with one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of Mechanic Auto Electrical & Electronics 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 Months)

1. Practice to identify components and their locations indicated on the wiring diagram.
2. Practice to identify the power source, ground connection, and controls for electrical circuits using a wiring diagram.
3. Diagnose series, parallel, series-parallel circuits.
4. Use of service manual wiring diagram for troubleshooting
5. Practice on Electrical Test Bench & Diode Tester.
6. Practice routine maintenance of terminal joints, wiring and renewal of damaged wires.
7. Practice on Check fuse and replace.
8. Testing of relay and solenoids and its circuit.
9. Practice in preparing wiring harness as per colour code
10. Trouble shooting of Instrument panel circuits, dashboard electrical circuits such as hazard sensing, warning & safety devices.
11. Practice on booster starting of engine.
12. Check battery voltage and practice on battery charging by series and parallel
13. Maintenance of battery
14. Trouble shooting of battery
15. Head light focusing and use of Luxmeter
16. Diagnosis of car radio wiring and speaker circuits problem
17. Servicing, repair and testing of various types of wiper motors, and accessories
18. Trouble shooting of wiper motor circuit with fuse.
19. Servicing, repairing and adjusting of electric horns.
20. Trouble shooting of Power window and accessories.
21. Repair and testing of various types of Power window and accessories.
22. Repair and testing of Side indicators, parking, hazards, brake light, reverse light, fog light.
23. Repair and testing of Door light/Roof light/Cabin light
24. Trouble shooting of central locking.
25. Repair and Testing of central locking.

B. BLOCK – II (09 Months)

1. Inspect, test and diagnose starting system
2. Overhauling of various types of Starter motor
3. Inspect, test and diagnose charging system
4. Overhauling of Alternator
5. Test alternator in an auto electrical test bench
6. Test starter in an auto electrical test bench
7. Trouble shooting in Ignition system
8. Overhauling & Testing Ignition system components.
9. Setting ignition timing
10. Diagnose engine electronic problems with scan tool
11. Diagnose and Testing of Temperature sensor, Pressure senor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor.
12. Trouble shooting in MPFI wiring circuit
13. Testing of MPFI components and replacement if necessary.
14. Troubleshooting in CRDI wiring circuit
15. Testing of CRDI components and replacement if necessary.
16. Check delivery from HP fuel Pump.
17. Performance test on A/c unit.
18. Insufficient cooling, Troubleshoot Abnormal noise from Magnetic clutch, Blower motor. Condenser Fan.
19. Checking Thermostatic Switch sensor its circuit.
20. Diagnose seat belt systems wiring system.
21. Diagnose air bag system wiring circuits and service warnings.
22. Diagnose AT system wiring circuits
23. Inspection of power steering control module circuit. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system.
24. Trouble shooting and remedy for steering wheel feels heavy at low speed, poor recovery from turns,
25. Diagnosis ABS problems
26. Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler
27. Identify various components of Electric and Hybrid vehicles.
28. Check Traction Motor for Proper Functioning.

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

8.1FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT FOR TWO YEARS TRADE)

SUBJECTS	Marks	Internal assessment based on competency	Full Marks	Pass Marks	Duration of Exam.
Basic Training(Block-I)		**250**	**250**	**150**	
Professional Skill	250		250	150	**08 hrs.**
Professional Knowledge	100		100	40	3 hrs.
Workshop Cal. & Sc.	50		50	20	3 hrs.
Engineering Drawing	50		50	20	4 hrs.
Employability Skill	50		50	20	3 hrs.
Basic Training (Block-II)		**250**	**250**	**150**	
Grand Total	**500**	**500**	**1000**	**550**	

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
4.In private Service centersindustries in India & abroad.
5. Self employment– Service centers

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE:MECHANIC AUTO ELECTRICAL & ELECTRONICS

LIST OF TOOLS & EQUIPMENTS FOR 16APPRENTICES

A : TRAINEES TOOL KIT:-

S.No.	Item with specification	Qty (Nos.)
1.	Allen Key set of 12 pieces (2mm to 14mm)	(5+1)
2.	Caliper inside 15 cm Spring	6
3.	Calipers outside 15 cm spring	6
4.	Center Punch 10 mm. Dia. x 100 mm.	6
5.	Dividers 15 cm Spring	6
6.	Electrician Screw Driver 250mm	6
7.	Hammer ball peen 0.5 kg with handle	6
8.	Hands file 20 cm. Second cut flat	6
9.	Philips Screw Driver set of 5 pieces	6
10.	Pliers combination 20 cm.	6
11.	Screw driver 20cm.X 9mm. Blade	6
12.	Screw driver 30 cm. X 9 mm. Blade	6
13.	Scriber 15 cm	6
14.	Spanner D.E. set of 12 pieces (6mm to 32mm)	6
15.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	6
16.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	6
17.	Steel rule 30 cm inch and metric	6
18.	Steel tool box with lock and key (folding type) 400x200x150 mm	6
19.	Wire cutter and stripper	6
20.	Offset Ring Spanner Set 6mm to 32mm Set of 12nos	6
21.	Combination Spanner Set 6mm to 32mm Set of 25nos	6

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.	Allen Key set of 12 pieces (2mm to 14mm)	4
4.	Alternator assembly	5 Nos
5.	Alternator Assembly with Vacuum pump	2 Nos
6.	Ammeter 300A/ 60A DC with external shunt	4
7.	Battery –charger	2
8.	Voltmeter 0 to 50V	1
9.	Caliper inside 15 cm Spring	4
10.	Calipers outside 15 cm spring	4
11.	Wiper motor assemblies	2
12.	Chisel 10 cm flat	4
13.	Chisels cross cut 200 mm X 6mm	4
14.	Circlip pliers Expanding and contracting type 15cm and 20cm each	4
15.	Clamps C 100mm	2
16.	Clamps C 150mm	2
17.	Starter motor axial type, Overrunning Clutch type	5 Each
18.	Cleaning tray 45x30 cm.	4
19.	Electrical horn(different types)	2ach
20.	MPFI Pump	2 nos
21.	Wiper motor assemblies	2 nos
22.	Pipe Wrench 350 mm	2nos
23.	Dividers 15 cm Spring	4
24.	Drift Punch Copper 15 Cm	4
25.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4
26.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
27.	Electric tester	4
28.	Engineer's Square 15 cm. Blade	4
29.	Engineers stethoscope.	1
30.	Executive Auto Electrical tool kit	1
31.	Feeler gauge 20 blades (metric)	4
32.	File flat 20 cm bastard	4
33.	File, half round 20 cm second cut	4
34.	File, Square 20 cm second cut	4
35.	File, Square 30 cm round	4
36.	File, triangular 15 cm second cut	4
37.	Files assorted sizes and types including safe edge file	2 set
38.	Flat File 25 cm second cut	4
39.	Flat File 35 cm bastard	4
40.	Cell tester	1

41.	Hydrometer	1 each
42.	Car Wiring Mock up Board	1 nos
43.	Two Wheeler Wiring Mock up board	1 nos
44.	Glow plug tester	2
45.	Granite surface plate 1600 x 1000 with stand and cover	1
46.	Growler	1
47.	Hacksaw frame adjustable 20-30 cm	10
48.	Hammer Ball Peen 0.2 Kg	4
49.	Hammer copper 1 Kg with handle	4
50.	Hammer Mallet	4
51.	Hammer Plastic	4
52.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2
53.	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
54.	Hand vice – 37 mm	2
55.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
56.	Impact screw driver	2
57.	Insulated Screw driver 20 cm x 9mm blade	4
58.	Insulated Screw driver 30 cm x 9mm blade	4
59.	Magnifying glass 75mm	2
60.	Marking out table 90X60X90 cm.	1
61.	Multimeter digital	5
62.	Oil can 0.25 liter capacity	4
63.	Outside micrometer 0 to 25 mm	4
64.	Outside micrometer 75 to 100 mm ,100 to 125 mm, 125 to 150 mm	1
65.	Philips Screw Driver set of 5 pieces	10
66.	Pliers combination 20 cm.	10
67.	Pliers flat nose 15 cm	2
68.	Pliers round nose 15 cm	2
69.	Pliers side cutting 15 cm	2
70.	Portable electric drill Machine	1
71.	Prick Punch 15 cm	4
72.	Punch Letter 4mm (Number)	2 set
73.	Scraper flat 25 cm	2
74.	Scriber 15 cm	2
75.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
76.	Spanner, adjustable 15cm.	2
77.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	4
78.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	2
79.	Steel rule 15 cm inch and metric	4
80.	Steel rule 30 cm inch and metric	4

81.	Stud extractor set of 3	2 sets
82.	Stud remover with socket handle	1
83.	Tachometer (Counting type)	1
84.	Taps and Dies complete sets BSF	1 set
85.	Taps and wrenches – metric	2 sets
86.	Thermostatic switch	2
87.	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
88.	Universal puller for removing pulleys, bearings	1
89.	vernier caliper 0-300 mm with least count 0.02mm	4
90.	Vice grip pliers	2
91.	Wire Gauge (metric)	2
92.	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	4
93.	4 Point relays	2
94.	5 Point relays	2
95.	Glow plug wrench	1
96.	Magneto Puller	2
97.	Demonstration Model of Power Window	1

C :GENERAL MACHINERY INSTALLATIONS:-

1	Functional/experiment model of different type of sensors of MPFI Engine	1
2	Functional/experiment model of different type of sensors of CRDI Engine	1
3.	Bench grinder	1
4.	Drilling machine (general purpose)	1
5.	Hand operated Press	1
6.	ABS Trainer/Demonstration Model	1
7.	Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board (vehicular model)	1
8.	Laptop/Desktop with LCD Projector	1 Nos

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 AUTO ELECTRICAL & ELECTRONICS

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 AUTO ELECTRICAL & ELECTRONICS

For Batch of 16 APPRENTICES

General Machinery Installations –

Sl. No.	Name & Description of Machines	Quantity
1	Auto Electrical test bench	1
2	Multi Scan Tool with oscilloscope	1
3	Spark Plug Cleaning and Testing Machine	1
4	Ultrasonic Injector Cleaning Machine	1
5	Battery Charger	1
6	Laptop	1

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.