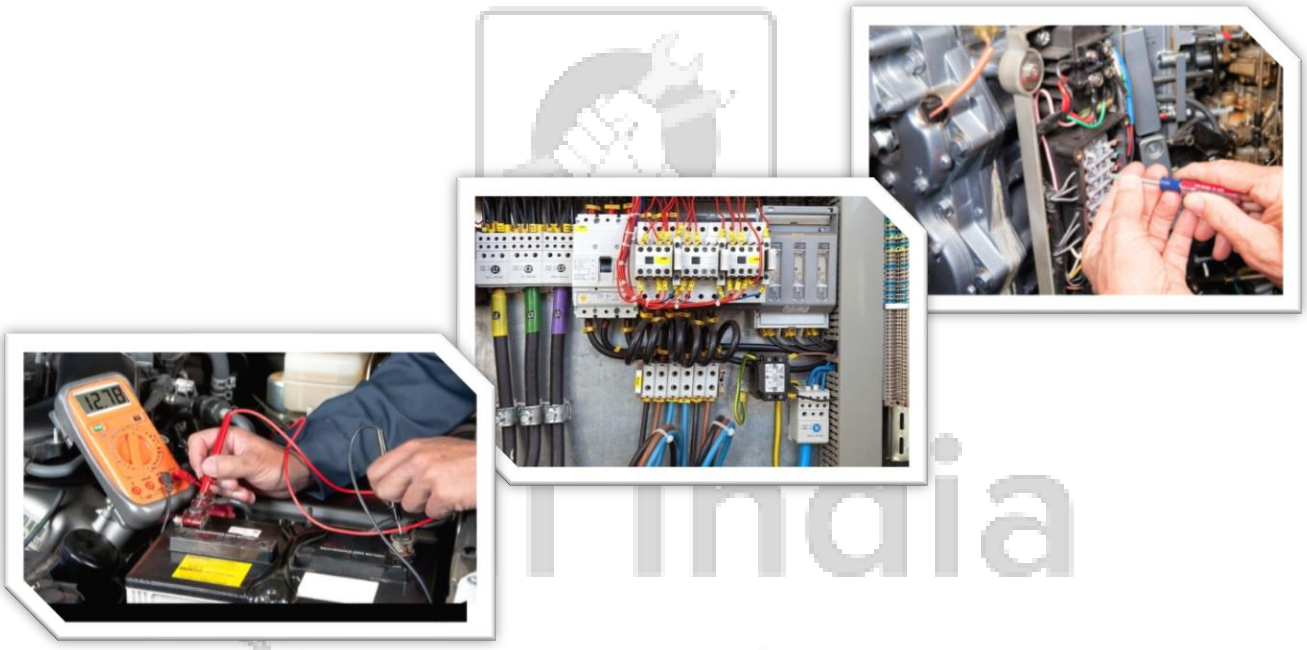
MECHANIC AUTO ELECTRICAL AND ELECTRONICS

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – AUTOMOTIVE

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

MECHANIC AUTO ELECTRICAL AND ELECTRONICS

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

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

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

Coordinator for the course: Sh. Nirmalya Nath, ADT CSTARI Kolkata

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	SP Rewaskar	ATI, Mumbai	ADT
2.	Akilesh Pandey	ATI, Mumbai	TO
3.	N. Ramesh Kumar	CTI, Chennai	TO
4.	R Manae	ATI, Mumbai	VI

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1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

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

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

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

1.2 Changes in Industrial Scenario

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

1.3 Reformation

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

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

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

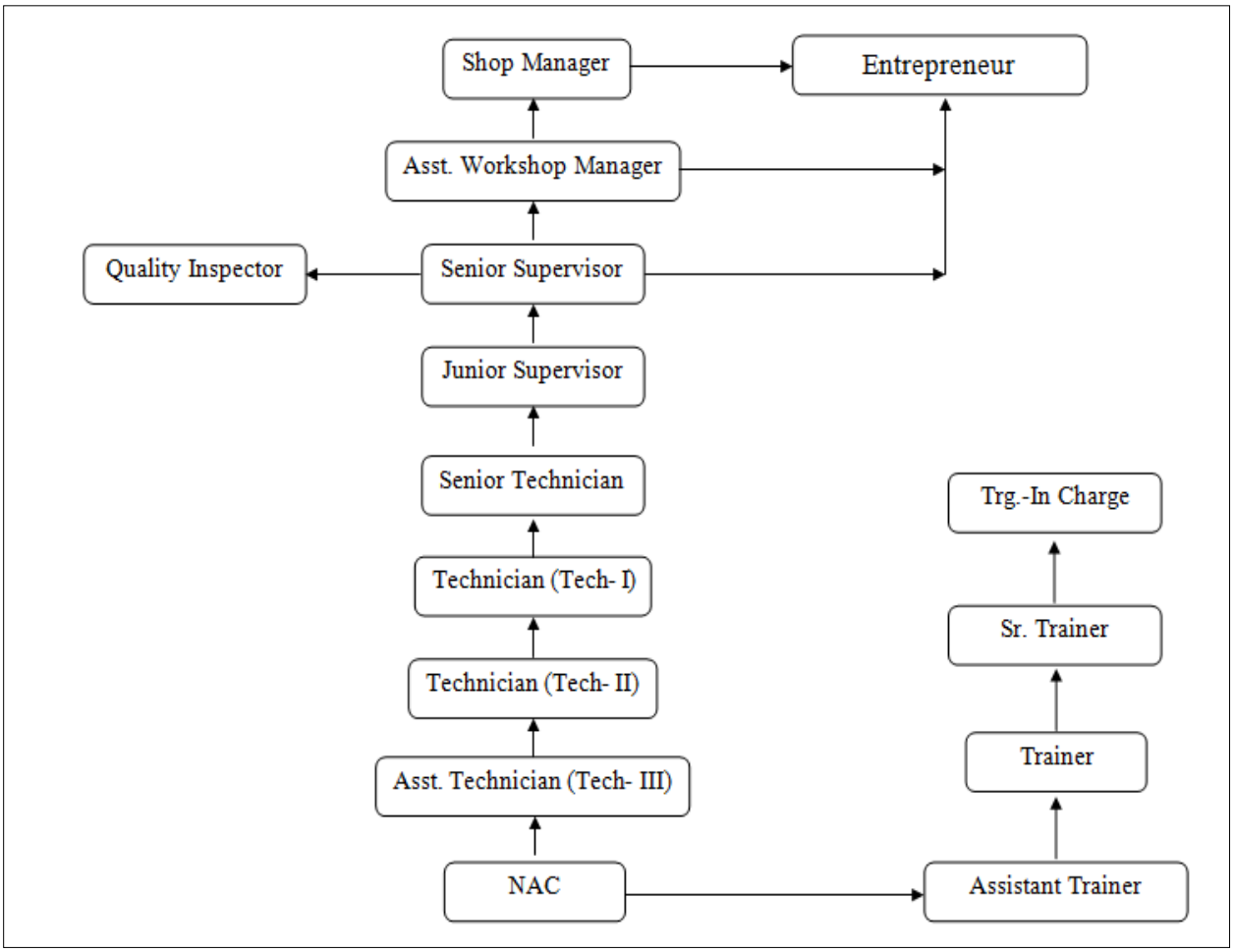
MECHANIC AUTO ELECTRICAL & ELECTRONICS trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional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

Broadly candidates need to demonstrate that they are able to:

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

2.2 CAREER PROGRESSION PATHWAYS:

- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

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

Total training duration details: -

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

A. Basic Training

For 02 yrs. course (Engg.) :-(**Total 06 months:** 03 months in 1st yr. + 03 months in 2nd yr.)
For 01 yr. course (Engg.) :-(**Total 03 months:** 03 months in 1st yr.)

S No.	Course Element	Total Notional Training Hours	
		For 02 Yrs. course	**For 01 Yr. course**
1.	Professional Skill (Trade Practical)	550	275
2.	Professional Knowledge (Trade Theory)	240	120
3.	Workshop Calculation & Science	40	20
4.	Engineering Drawing	60	30
5.	Employability Skills	110	55
	Total (Including internal assessment)	**1000**	**500**

B. On-Job Training:-

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

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

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

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

C. Total training hours:-

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

2.4 ASSESSMENT & CERTIFICATION:

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

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment

guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

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

3. JOB ROLE

Brief description of Job roles:

Mechanic Auto Electrical &Electronics**,** Installs, repairs replaces and overhauls wiring, starters, generators, distributors and other electrical equipment of motor vehicles. Examines vehicle battery, checks voltage and specific gravity using special equipment such as voltmeter hydrometer, heavy discharge tester, etc. and ensures that battery is in good condition. Checks vehicle wiring, locates faults and rectifies defects by replacing damaged wire or connecting ends with insulation tape. Starts engine to check whether alternator is charging correctly, and if distributor, condenser coil and cut out are functioning properly. Estimates nature of defects and reports components to be replaced or repaired. Dismantles and repairs electrical units and components such s generator, distributor etc. where required. Replaces repaired kit or unit in vehicle and connects it with battery. Conducts thorough examination of various electrical fittings such as lights, panel indicators, fuel pumps, etc and rectifies defects. Checks condition and makes necessary adjustments. May do armature winding.May drive vehicles on road. May charge batteries.Fits, assembles and repairs various kinds of electronic equipment in factory or workshop or at place of use. Examines drawings and wiring diagrams; checks parts for accuracy of fit and minor adjustments; assembles parts or mounts them on chassis or panels with aid of hand tools; Installs and connects wiring, soldering joints equipment, diagnoses faults with aid of electronic testing equipment; Dismantles equipment if required and replaces faulty parts or warning

In addition, Mechanic Auto Electrical &Electronics have the ability to visualize the job, good coordination, attitude, manual dexterity and perform work related mathematical calculations.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

May be designated as Mechanic Auto Electrical & Electronics according to nature of work done.

Reference NCO: 7412.0701 **-** Electrician, Automobile

4. NSQF LEVEL COMPLIANCE

NSQF level for MECHANIC AUTO ELECTRICAL & ELECTRONICS trade under ATS: **Level 5**

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

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

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

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

The Broad Learning outcome of Mechanic Auto Electrical & Electronics trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

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

5. GENERAL INFORMATION

Name of the Trade	MECHANIC AUTO ELECTRICAL & ELECTRONICS
NCO – 2015	**7412.0701**
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of Apprentices	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related trade of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for Mechanic Auto Electrical &Electronics Apprenticeship	Mechanic Auto Electrical and 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.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Mechanic Auto Electrical & Electronics course of 02 years duration under ATS.

Block I &II:-

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

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. Identify components and their locations indicated on the wiring diagram.
2. 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. Operate Electrical Test Bench & Diode Tester.
6. Routine maintenance of terminal joints, wiring and renewal of damaged wires.
7. Check fuse and replace.
8. Test relay and solenoids and its circuit.
9. Prepare wiring harness as per colour code

10. Trouble shooting of Instrument panel circuits, dashboard electrical circuits such as hazard sensing, warning & safety devices.
11. 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. Service, repair and test various types of wiper motors, and accessories
18. Trouble shooting of wiper motor circuit with fuse.
19. Perform servicing, repairing and adjusting of electric horns.
20. Trouble shooting of Power window and accessories.
21. Repair and test various types of Power window and accessories.
22. Repair and test Side indicators, parking, hazards, brake light, reverse light, fog light.
23. Repair and test Door light/Roof light/Cabin light
24. Trouble shooting of central locking.
25. Repair and Test central locking.

Block – II

26. Inspect, test and diagnose starting system
27. Overhauling of various types of Starter motor
28. Inspect, test and diagnose charging system
29. Overhauling of Alternator
30. Test alternator in an auto electrical test bench
31. Test starter in an auto electrical test bench
32. Trouble shooting in Ignition system
33. Overhauling & Testing Ignition system components.
34. Setting ignition timing
35. Diagnose engine electronic problems with scan tool
36. Diagnose and Testing of Temperature sensor, Pressure senor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor.
37. Trouble shooting in MPFI wiring circuit
38. Testing of MPFI components and replacement if necessary.
39. Troubleshooting in CRDI wiring circuit
40. Testing of CRDI components and replacement if necessary.
41. Check delivery from HP fuel Pump.
42. Performance test on A/c unit.
43. Insufficient cooling, Troubleshoot Abnormal noise from Magnetic clutch, Blower motor. Condenser Fan.

44. Checking Thermostatic Switch sensor its circuit.
45. Diagnose seat belt systems wiring system.
46. Diagnose air bag system wiring circuits and service warnings.
47. Diagnose AT system wiring circuits
48. Inspection of power steering control module circuit. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system.
49. Trouble shooting and remedy for steering wheel feels heavy at low speed, poor recovery from turns,
50. Diagnosis of ABS problems
51. Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler
52. Identify various components of Electric and Hybrid vehicles.
53. Check Traction Motor for Proper Functioning.

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1. 2. Recognize and report all unsafe situations according to site policy.
	1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures in regard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	1. 14. Avoid waste and dispose waste as per procedure
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including basic electrical and	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, friction.
	2.2 Measure dimensions as per drawing

apply in day to day work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Power transmission, Pressure]*	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation &earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Choose suitable hand tools and measuring instruments.	4.1 Select appropriate hand tools (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure variables of the components & record data to analyse the with given measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts
6. Explain energy conservation, global warming and pollution and contribute	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment

in day to day work by optimally using available resources.	pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ nonfinancing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
Block-I& II (Section:10)	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II**(section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
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,	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.

	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 ignition engine **(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	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

	gravity test. Checking battery for defects.	
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 lights Temperature 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	**Internal Assessment/Examination 03days**	

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

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
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. Identification of various 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 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. Tracing wiring circuit in Antilock Braking system	Electric brakes, Electro hydraulic braking (EHB), ABS break 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.
8-9	Automatic transmission Identification of Automatic transmission components and related sensors. Tracing wiring circuit in	Automatic Transmissions - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches.

	Automatic Transmission Electronic Power Steering Identification of EPS components and related sensors. Tracing wiring circuit in EPS.	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 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. Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Electric servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems.
	Internal Assessment/Examination 03days	

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

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

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

	weight, Density, unit of density.	and auxiliary) - Types of arrowhead - Leader Line with text
6.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	**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.	Forces definition. - Definition and example of compressive, tensile, shear forces, axial and tangential forces. Stress, strain, ultimate strength, factor of safety for MS	**Method of presentation of Engineering Drawing** - Pictorial View - Orthogonal View - Isometric view
8.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	**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
9.	**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.	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance.
10.	**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two	**Construction of Geometrical Drawing Figures:** - Polygons and their values of included angles. Conic Sections (Ellipse)

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

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Trigonometry:** Trigonometric ratios, Trigonometric tables. - Finding the value of unknown sides and angles of a triangle by Trigono metrical method. - Finding height and distance by trigonometry.	- Machined components; concept of fillet & chamfer; surface finish symbols.
2.	**Friction** and its application in Workshop practice.	- Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
3.	**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.	- Reading & interpretation of assembly drawing and detailing.
4.	**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	- Reading of drawing. Simple exercises related to missing lines, dimensions and views. How to make queries.

	power, Horse power, energy, unit of electrical energy. Concept of earthing.	
5.	**Heat treatment** – Necessity, different common types of Heat treatment.	- Simple exercises related to trade related symbols. - Solution of NCVT test papers.
6.	**Graph:** - Read images, graphs, diagrams – bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	
7.	**Transmission of power:** By belt, pulleys & gear drive.	
8.	**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	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I (Duration – 55 hrs.)	
1. English Literacy Duration : 20 Hrs.	Marks : 09
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy Duration : 20 Hrs.	Marks : 09
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks),

	Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills Duration : 15 Hrs. Marks : 07	
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
Block – II **Duration – 55 hrs.**	
4. Entrepreneurship Skills Duration : 15 Hrs. Marks : 06	
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to

	the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale &Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes& procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity Duration : 10 Hrs. Marks : 05	
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education Duration : 15 Hrs. Marks : 06	
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.

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

10. DETAILS OF COMPETENCIES (ON-JOBTRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MECHANIC AUTO ELECTRICAL AND ELECTRONICS TRADE:

1. Checks vehicle wiring, locates faults and rectifies defects
2. Diagnose electrical and electronics circuits
3. Testing of Electrical equipment in testers
4. Trouble shooting Panel and Electrical Circuits
5. Servicing, repair and adjusting Motor vehicle electrical and electronics accessories.
6. Inspecting Electrical and Electronics systems and its components
7. Diagnoses and testing of Sensors and actuators in motor vehicle

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

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

Block – I

1. Identify components and their locations indicated on the wiring diagram.
2. 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. Operate Electrical Test Bench & Diode Tester.
6. Routine maintenance of terminal joints, wiring and renewal of damaged wires.
7. Check fuse and replace.
8. Test relay and solenoids and its circuit.
9. Prepare wiring harness as per colour code
10. Trouble shooting of Instrument panel circuits, dashboard electrical circuits such as hazard sensing, warning & safety devices.
11. 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. Service, repair and test various types of wiper motors, and accessories
18. Trouble shooting of wiper motor circuit with fuse.
19. Perform servicing, repairing and adjusting of electric horns.
20. Trouble shooting of Power window and accessories.
21. Repair and test various types of Power window and accessories.
22. Repair and test Side indicators, parking, hazards, brake light, reverse light, fog light.
23. Repair and test Door light/Roof light/Cabin light
24. Trouble shooting of central locking.
25. Repair and Test central locking.

Block – II

26. Inspect, test and diagnose starting system
27. Overhauling of various types of Starter motor
28. Inspect, test and diagnose charging system
29. Overhauling of Alternator
30. Test alternator in an auto electrical test bench
31. Test starter in an auto electrical test bench
32. Trouble shooting in Ignition system
33. Overhauling & Testing Ignition system components.
34. Setting ignition timing
35. Diagnose engine electronic problems with scan tool
36. Diagnose and Testing of Temperature sensor, Pressure senor, potentiometer, magnetic induction sensor, cam shaft sensor, crankshaft position sensor.
37. Trouble shooting in MPFI wiring circuit
38. Testing of MPFI components and replacement if necessary.
39. Troubleshooting in CRDI wiring circuit
40. Testing of CRDI components and replacement if necessary.
41. Check delivery from HP fuel Pump.
42. Performance test on A/c unit.
43. Insufficient cooling, Troubleshoot Abnormal noise from Magnetic clutch, Blower motor. Condenser Fan.
44. Checking Thermostatic Switch sensor its circuit.
45. Diagnose seat belt systems wiring system.
46. Diagnose air bag system wiring circuits and service warnings.
47. Diagnose AT system wiring circuits
48. Inspection of power steering control module circuit. Checking & adjusting power steering fluid, Pressure testing a power steering system, Flushing a power steering system.
49. Trouble shooting and remedy for steering wheel feels heavy at low speed, poor recovery from turns,
50. Diagnosis of ABS problems
51. Inspection of shift lever switch, throttle position sensor, speed sensor and automatic transmission wiring harness coupler
52. Identify various components of Electric and Hybrid vehicles.
53. Check Traction Motor for Proper Functioning.

Note:

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

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL &PROFESSIONAL KNOWLEDGE

MECHANIC AUTO ELECTRICAL & ELECTRONICS			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 16 Apprentices)			
A. TRAINEES TOOL KIT			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1.	Allen Key set of 12 pieces	(2mm to 14mm)	(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 : INSTRUMENTS & GENERAL SHOP OUTFIT			

22.	Adjustable spanner	(pipe wrench 350 mm)	2
23.	Air blow gun with standard accessories		1
24.	Allen Key set of 12 pieces	(2mm to 14mm)	4
25.	Alternator assembly		5 Nos
26.	Alternator Assembly with Vacuum pump		2 Nos
27.	Ammeter	300A/ 60A DC with external shunt	4
28.	Battery –charger		2
29.	Voltmeter	0 to 50V	1
30.	Caliper inside	15 cm Spring	4
31.	Calipers outside	15 cm spring	4
32.	Wiper motor assemblies		2
33.	Chisel	10 cm flat	4
34.	Chisels cross cut	200 mm X 6mm	4
35.	Circlip pliers	Expanding and contracting type 15cm and 20cm each	4
36.	Clamps C	100mm	2
37.	Clamps C	150mm	2
38.	Starter motor axial type, Overrunning Clutch type		5 Each
39.	Cleaning tray	45x30 cm.	4
40.	Electrical horn(different types)		2ach
41.	MPFI Pump		2 nos
42.	Wiper motor assemblies		2 nos
43.	Pipe Wrench	350 mm	2nos
44.	Dividers	15 cm Spring	4
45.	Drift Punch Copper	15 Cm	4
46.	Drill twist	1.5 mm to 15 mm (various sizes) by 0.5 mm	4
47.	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
48.	Electric tester		4
49.	Engineer's Square	15 cm. Blade	4
50.	Engineers stethoscope.		1
51.	Executive Auto Electrical tool kit		1

52.	Feeler gauge	20 blades (metric)	4
53.	File flat	20 cm bastard	4
54.	File, half round	20 cm second cut	4
55.	File,	Square 20 cm second cut	4
56.	File,	Square 30 cm round	4
57.	File,	triangular 15 cm second cut	4
58.	Files assorted sizes and types including safe edge file		2 set
59.	Flat File	25 cm second cut	4
60.	Flat File	35 cm bastard	4
61.	Cell tester		1
62.	Hydrometer		1 each
63.	Car Wiring Mock up Board		1 nos
64.	Two Wheeler Wiring Mock up board		1 nos
65.	Glow plug tester		2
66.	Granite surface plate	1600 x 1000 with stand and cover	1
67.	Growler		1
68.	Hacksaw frame adjustable	20-30 cm	10
69.	Hammer Ball Peen	0.2 Kg	4
70.	Hammer copper	1 Kg with handle	4
71.	Hammer Mallet		4
72.	Hammer Plastic		4
73.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm		2
74.	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
75.	Hand vice –	37 mm	2
76.	Hollow Punch set of seven pieces	6mm to 15mm	2 sets each
77.	Impact screw driver		2
78.	Insulated Screw driver	20 cm x 9mm blade	4
79.	Insulated Screw driver	30 cm x 9mm blade	4
80.	Magnifying glass	75mm	2

81.	Marking out table.	90X60X90 cm	1
82.	Multimeter digital		5
83.	Oil can	0.25 liter capacity	4
84.	Outside micrometer	0 to 25 mm	4
85.	Outside micrometer	75 to 100 mm ,100 to 125 mm, 125 to 150 mm	1
86.	Philips Screw Driver	set of 5 pieces	10
87.	Pliers combination.	20 cm	10
88.	Pliers flat nose	15 cm	2
89.	Pliers round nose	15 cm	2
90.	Pliers side cutting	15 cm	2
91.	Portable electric drill Machine		1
92.	Prick Punch	15 cm	4
93.	Punch Letter	4mm (Number)	2 set
94.	Scraper flat	25 cm	2
95.	Scriber	15 cm	2
96.	Spanner D.E.	set of 12 pieces (6mm to 32mm)	4
97.	Spanner, adjustable 15cm.		2
98.	Spanner, ring	set of 12 metric sizes 6 to 32 mm.	4
99.	Spanners socket with speed handle,	T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	2
100.	Steel rule	15 cm inch and metric	4
101.	Steel rule	30 cm inch and metric	4
102.	Stud extractor set of 3		2 sets
103.	Stud remover with socket handle		1
104.	Tachometer (Counting type)		1
105.	Taps and Dies complete sets BSF		1 set
106.	Taps and wrenches – metric		2 sets
107.	Thermostatic switch		2
108.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
109.	Universal puller for removing pulleys, bearings		1
110.	vernier caliper	0-300 mm with least count	4

		0.02mm	
111.	Vice grip pliers		2
112.	Wire Gauge (metric)		2
113.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	4
114.	4 Point relays		2
115.	5 Point relays		2
116.	Glow plug wrench		1
117.	Magneto Puller		2
118.	Demonstration Model of Power Window		1
C : GENERAL MACHINERY INSTALLATIONS			
119.	Functional/experiment model of different type of sensors of MPFI Engine		1
120.	Functional/experiment model of different type of sensors of CRDI Engine		1
121.	Bench grinder		1
122.	Drilling machine (general purpose)		1
123.	Hand operated Press		1
124.	ABS Trainer/Demonstration Model		1
125.	Working Condition of Diesel Engine – CRDI - 4 stroke Engine Assembly with fault simulation board (vehicular model)		1
126.	Laptop/Desktop with LCD Projector		1

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**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		16+1 set
2.	Set square celluloid	45^o (250 X 1.5 mm)	16+1 set
3.	Set square celluloid	30^o-60^o (250 X 1.5 mm)	16+1 set
4.	Mini drafter		16+1 set
5.	Drawing board	(700mm x500 mm) IS: 1444	16+1 set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		16
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

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.		

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :	**Year of Enrollment :**
Name & Address of ITI (Govt./Pvt.) :	**Date of Assessment :**
Name & Address of the Industry :	**Assessment location: Industry / ITI**
Trade Name : **Semester:**	**Duration of the Trade/course:**
Learning Outcome:	

Sl. No	Candidate Name	Father's/Mother's Name	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	Total internal assessment Marks	Result (Y/N)
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														