MECHANIC REPAIR & MAINTENANCE OF TWO WHEELER

COMPETENCY BASED CURRICULUM

(Duration: 1 Yr. 3 Months)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 4

SECTOR – AUTOMOBILE

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 REPAIR & MAINTENANCE OF TWO WHEELER

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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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

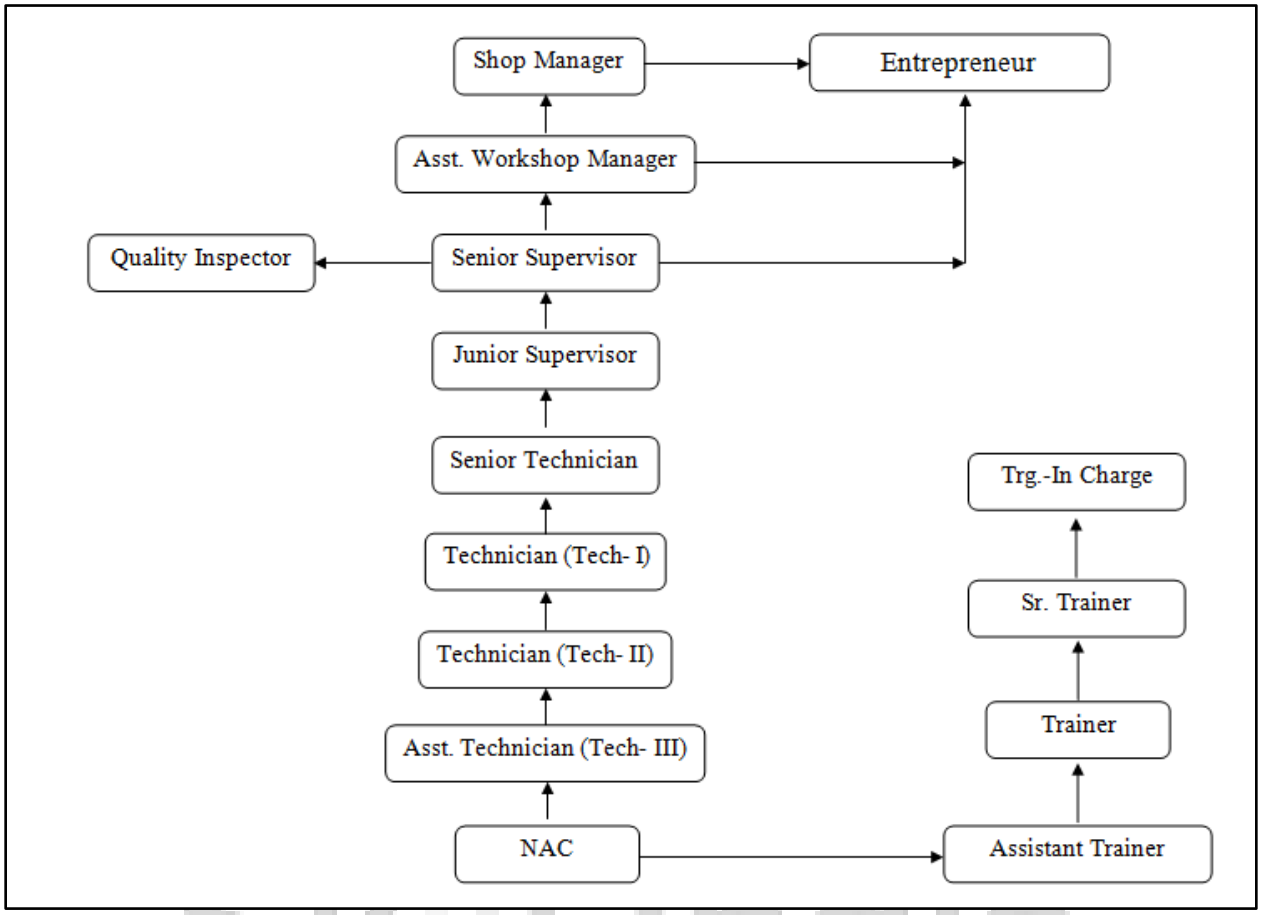
Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational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

MECHANIC REPAIR & MAINTENANCE OF TWO WHEELER trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of one year (01 Block of 15 months duration including basic training). 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 job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:



2.3 COURSE STRUCTURE:

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

Total training duration details: -

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

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

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

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

Performance Level	Evidence
(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	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy

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

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

Reference NCO code 2015: 7231.0100 - Mechanic, Automobile

4. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Repair & Maintenance of Two Wheeler trade under ATS: **Level 4**

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 Repair & Maintenance of Two Wheeler trade under ATS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice.	Factual knowledge of field of knowledge or study	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment.	Responsibility for own work and learning.

5. GENERAL INFORMATION

Name of the Trade	**MECHANIC REPAIR & MAINTENANCE OF TWO WHEELER**
NCO - 2015	7231.0100 Mechanic, Automobile
NSQF Level	Level – 4
Duration of Apprenticeship Training (Basic Training + On-Job Training)	3 months+ One year (01 Blocks of 15 month duration).
Duration of Basic Training	a) Block –I : 3 months **Total duration of Basic Training: 3 months**
Duration of On-Job Training	a) Block–I: 12 months **Total duration of Practical Training: 12 months**
Entry Qualification	Passed 10th class examination under 10+2 system of education or its equivalent
Selection of Apprenticeship	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for basic Training	As per related trade of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	Six months
CTS trades eligible for Mechanic Repair & Maintenance of Two Wheeler Apprenticeship	**Mechanic Repair & Maintenance of Two Wheeler**

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 Repair & Maintenance of Two Wheeler course of 01 years duration under ATS.

Block I:

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, Unit, Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity, Heat & Temperature, Basic Electricity etc.]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Lines, Free hand drawing, Drawing of Geometrical Figures , Sizes and Layout of Drawing Sheets, Method of presentation of Engineering Drawing, Drawing of Solid figures, Free hand Drawing of Solid figures, Free Hand sketch, Projections, Drawing of Orthographic projection in 3rd angle etc.]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNINGOUTCOME

Block – I

1. Apply safety precautions that are observed in workshop.
2. Overhaul and trouble shoot suspension, shock absorbers & its maintenance
3. Introduction of tubeless tyres & its maintenance
4. Service the brake system.
5. Replacement of brake shoes / brake pads.
6. Repair and maintenance of mechanical brake system, hydraulic disc brake system.

7. Road test for braking efficiency.
8. Overhaul clutch assembly and adjust clutch lever free play.
9. Repair automatic clutch, automatic transmission and transmission system
10. Overhaul gear box and Check vehicle noise from transmission system & identification of faults.
11. Dismantle cylinder head and decarbonising.
12. Recondition valves and valve seats, Check and adjust valve timing.
13. Remove piston and connecting rod assembly.
14. Dismantle gudgeon pins and bushes, piston-rings, cleaning, checking and refitting them.
15. Check main bearings and crankshaft, connecting rod bearings, timing chain tension and replacing worn chain.
16. Check alignment of connecting rod for twist and bend.
17. Check warping in the cylinder head & block surface, cylinder bore.
18. Reassemble of engine parts in correct sequence and set of ignition timing as per specification.
19. Remove and refit, test and service exhaust system and catalytic converter.
20. Clean petrol fuel lines, tanks & checking for leakages, smoke and setting for exhaust gas emission measurement.
21. Check and set idle speed of petrol engine.
22. Test induction coil and condenser, Set Ignition timing, clean and checking of spark plug.
23. Electronic ignition repair and maintenance.
24. Overhaul steering, repair and alignment of chassis.
25. Maintenance of lead - acid battery, Charge battery from a battery charger.
26. Repair components in lighting circuit, testing bulbs and replacing fuse.
27. Overhaul starter motor.
28. Repair and adjust electrical horns.
29. Trouble tracing in electrical circuits using AVO meter. Digital meters & Switches.

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 and explain different mathematical calculation & science in the field of study including basic	2.1 Explain concept -Unit,, Basic Mathematics, Percentage, Material Science, Mass, Weight and Density, Mensuration, Elasticity, Heat &Temperature, Basic Electricity,

electrical. *[Different mathematical calculation & science -,Unit, Basic Mathematics, Percentage, Material Science ,Mass, Weight and Density, Mensuration, Elasticity ,Heat & Temperature ,Basic Electricity etc.]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different Lines, Free hand drawing , Drawing of Geometrical Figures , Sizes and Layout of Drawing Sheets, Method of presentation of Engineering Drawing, Drawing of Solid figures, Free hand Drawing of Solid figures, Free Hand sketch, Projections, Drawing of Orthographic projection in 3rd angle etc.]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts
6. Explain energy	6.1 Explain the concept of energy conservation, global

conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/ organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
Block-I (Section:10 in the competency based curriculum)	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **Block – I**(section: 10) must ensure that the trainee works in familiar, predictable, routine, situation of clear choice. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, etc.); **Execution** apply factual knowledge of field of knowledge, recall and demonstrate practical skill during performing the work in routine and repetitive in narrow range of application, using appropriate rule and tool, complying with basic arithmetic and algebraic principles and language to communicate in written or oral with required clarity; **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for his/her own work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week no.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	Familiarisation with institute, Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor.	Two wheelers auto Industry in India - leading manufacturers, new product. 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), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Technical terms used in engine, Engine specification
2.	Practice on Dismantling three wheeler engine and inspection of cylinder head, piston, piston ring, connecting rod Practice on measurement of piston ring gap, the piston ring to groove clearance, piston OD, cylinder -to-piston clearance, piston pin OD, piston pin hole ID in an X and Y axis, piston-to-pin clearance connecting rod small end ID	Basic engine components Engine cams & Description & functions of pistons, piston rings, connecting rod and piston pins and materials. Used recommended clearances for the rings and its necessity, precautions while fitting rings, common troubles and remedies of piston. Description and function of Crank shaft, Engine bearings.
3.	Identify valves and condition of valve and seat. Inspection of rocker arm and rocker arm shaft, camshaft, valve spring, valve guide, valve guide replacement, valve seat inspection and replacing. Cylinder head assembly. Inspection of valve clearance and Ignition timing and setting.	Valves & Valve Trains Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, Valve-timing setting. Description of Camshafts & drives, importance of Cam lobes, Timing belts & chains. Trouble shooting procedure for Excessive smoke, overheating, knocking or abnormal noise. Troubleshooting procedure for cam chain noise, and cam chain slack excessively.
4.	Practice on check the throttle cable for deterioration, damage or kinks, measure the throttle grip free play, and	Intake & exhaust systems - Carbureted systems, Principle of Carburetor, type of carburetor -working of constant velocity

	adjustments. Check the carburetor idle speed and adjust as per manual. Practice on compression test. Practice on throttle valve disassembly, check the throttle valve and jet needle surfaces for presence of dirt, scratches or wear and assemble the throttle valve.	type carburetor, Carburetor operation-Carburetion, Carburetor systems, Metering jets, Accelerating, Carburetor barrels , Carburetor filters Diesel fuel Injection system, Tanks & lines, Fuel lines idle speed circuit, slow speed circuit, high speed circuit, air cleaners, Intake manifolds.
5.	Perform removal of fuel tank; check that fuel flow freely from the petrol tap. Practice on removal of petrol tap and clean the strainer and assemble. Diagnose - causes and remedy for engine not starting, high fuel consumption, Practice on engine tune.	Gasoline /Diesel Fuel Systems: Gasoline fuel characteristics, Diesel fuel characteristics, Difference between Gasoline and diesel fuel. Controlling fuel burn, Stoichiometric ratio (air-fuel ratio), Air density, Fuel supply system, Pressure & vacuum.
6.	Identify steering system components in two wheelers, Practice on handle bar removal, inspection and assembling of handle bar. Practice on removal of front fork, inspection of front fork spring, fork tube, piston, slider and assembling of front fork. Practice on steering stem removal, steering stem adjustment, Inspect condition of fork and adjust rake of front fork, dismantle trailing link, adjust and service of heavy duty thrust races.	Introduction to steering Principles of steering, Description of different types of steering & handle, fork mounted over races. Description, construction and function of steering stem. Troubleshooting Procedure for Hard steering Steers to one side or does not track strain, front wheel wobbling, Soft suspension, Hard suspension, Front suspension noise.
7.	Identify suspension system components in two and three wheelers, Practice on rear shock absorber removal, inspection of shock absorber spring and assembling of shock absorber. Practice on removal of swing arm, inspection of pivot bolt, swing arm Inspection of condition of shock absorbers. Servicing of suspension, changing bush.	Suspension Systems- Principles of suspension, Suspension force, Description, location, suspension-description, construction and working principle of telescopic front suspension, suspension oil, oil seal installation, Shock absorber types-Hydraulic shock absorbers, Gas-pressurized shock absorbers, Load-adjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load-adjustable shock absorbers
8.	Practice on removing front wheel from vehicle, inspection of front wheel axle	Wheels & Tyres-Function of wheel and construction, Wheel types-spoke,

	run out, front wheel bearing inspection, front wheel rim run out, brake drum inspection, and assembling of front wheel. Practice on removing rear wheel from vehicle, inspection of rear wheel axle run out, rear wheel bearing inspection, rear wheel rim run-out, brake drum inspection, driven sprocket inspection, driven sprocket removal, and assembling of rear wheel, driven sprocket installation. Check the chain slack and adjust as per manual. Dismantling tyres and tubes checking puncture.	cast wheel & sizes, Wheel balancing, Rim sizes & designations, Tyre function and structure, size and designation, Radial ply tyres, Tubeless tyre, Center of gravity, Relation between tyre pressure and life, Tube size, TUFFUP tube. Aspect ratio of tyre, Puncture procedure, Repair of TUFFUP tube, Tyre construction- Types of tyre construction, Tyre materials, Tyre sizes & designations, Tyre information, Tyre tread designs, Effects of air pressure and uneven wear pattern.
9.	Measure the front brake lever free play and adjust as per manual, Measure the rear brake pedal free play and adjust as per manual, Servicing the brake system, Cleaning, checking, greasing and assembling.	Braking Systems - Braking fundamentals Principles of braking, description, construction and operation of Drum & disc brakes, advantage over drum brake, Description and working principle of master cylinder, Hydraulic pressure & force, Brake fade. Braking system components- Brake pedal/lever, Brake fluid hose, Brake fluid, Bleeding, Applying brakes, Brake force, Brake light switch
10.	Practice on transmission disassembly, inspection of main shaft, counter shaft, gearshift drum, shift fork, guide pin and gears and assembly of transmission. Removal of oil pump and inspection and assembly of oil pump. Gearshift linkage disassembly, inspection and assembly of gearshift linkage.	Clutches & Transmission:- Clutch principles, Wet & dry clutches Single-plate clutches, Multi-plate clutches, Operating mechanisms, Description of cam chain mechanism. Automatic clutch Gearbox layout & operation Gearbox layouts, description of gear shift mechanism, gear ratio, Gearbox operation, Gear drive position - Neutral, 1st to 5th position. Trouble shooting procedure for Clutch slip when accelerating, clutch will not disengage, motor cycle creeps with clutch disengaged.
11.	Practice on A.C. Generator removal, inspection and installation. Practice on removal of cam chain	Auto electrical Thermistor, Description and function of ignition switch, alternator, Regulator/rectifier, Ignition

	tensioner, inspection of tensioner spring and pushrod, installation.	principles, Ignition components, Battery power source, Ignition coil, DC/AC CDI, TCI Contact breaker, capacitor / condenser, Distributors, Distributor types, High-tension leads, Spark plugs, Spark plug components, Principal of electronic ignition, advantage of electronic ignition.
12.	Practice on removal of battery, specific gravity test, and practice on battery charging, practice on removal of regulator/rectifier, inspection, and assembling. Identify the various parts of LPG/ CNG kit and Trouble shooting of the same	Troubleshooting procedure for No sparks at plugs, Engine starts but runs poorly, No lights come on when ignition switch is turned ON, All lights come on but dimly when ignition switch is turned ON, and Headlight beams do not shift when HI-LO switch is operated. Misfiring. Study about LPG / CNG powered engines used in Two Wheelers. Safety while handling gas units. Emission Control-Sources of emission, Combustion, Hydrocarbons, Hydrocarbons in exhaust gases.
13.	**Revision & Internal assessment.**	

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	Units, Derived and fundamental, types of system FPS, CGS, MKS and their conversion. Metric weights and measurements, units conversion factors	Importance of engineering drawing as a communication medium, different types of drawing - Machine Drawing, Production Drawing, Part Drawing, Assembly Drawing, Drawing instruments, equipment and materials and their uses
2.	Fractions- Addition and subtraction, Fractions and whole numbers, Combined addition and subtraction, Multiplication and division of fractions. Operations in problems involving fractions.	Scales - Recommended scales, reduced & enlarged Drawing Sheet sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheet, sizes of title block and its contents. Using drawing instruments to draw straight lines, rectangles, squares, circles, polygons.
3.	Order of performing (BODMAS) Mathematical operators, Integers - Rules for dealing with integers, Addition, subtraction, Multiplication and division.	Free hand sketching of nuts & bolts-studs with dimension from samples.
4.	Ratio and proportion. Percentages, Examples of ratios in Automotive technology profit and loss, Discount.	Lettering and Dimensioning - Types of Lettering, Guide Lines for lettering, Recommended sizes of letters and numbers, Single stroke letters, Dimensioning -rules and systems of dimensioning - dimensioning a given drawing.
5.	Simple interest and compound interest depreciation calculation. Effect of Alloying elements and properties of cast iron and steel alloys. Shop problems on force, work done, energy & power.	Free hand sketch of clutch Assembly used in two wheeler
6.	Calculation of volume of square, rectangular & conical blocks, volume of cylinders (solid & hollow)	Free hand sketch of different types of valves & pistons used in two wheelers.
7.	Electricity and its effects, static and dynamic electricity- AC & DC differences. Magnets-natural & artificial types poles of magnets, magnetic fields. Definition of	Freehand sketching of different types of valves & pistons. Free hand sketch of 2 & 4 stroke cycles.

	ampere, volt & ohm-units of ampere, volt, ohm, Ohm's Law.	
8.	Properties and uses in automobile industries- copper, zinc, lead, tin, aluminum, brass, bronze, solder bearing metals, timber and rubber. Nylon, P.V.C., PP (poly prop line, polymer).	Free hand sketch of electrical symbols and different electrical circuits of 2 wheeler. Free hand sketch of assembly of2 wheelers.
9.	Materials - Stress, strain,- Definition of Stress, Types of stress- Tensile, compressive, shear , Examples of the three basic stresses in automotive components , calculation of stress and strain in automotive application, Stress raisers, Strain-, Tensile, compressive, Shear strain, Tensile strength, Factor of safety, Torsional stress, Strain energy.	Orthographic Projection - Definition - Planes of Projection - Four quadrants -Reference Line, First angle projection - Third angle projection.
10.	Definition of cold working and Hot working and its properties on sheet metal. Advantage of Deep drawing material. Importance of Iron- carbon diagram in heat treatment process.	Isometric Projection - Definition - Isometric axes, lines and planes, Isometric Scale -Isometric view. Drawing of isometric views of plane figures, Drawing of isometric views of prisms and pyramids, Drawing of isometric view of cylinders and cones
11.	Different Type of cutting fluids and their properties. Calculation of cutting speed, feed and drilling time.	Free hand sketch of combustion chambers of different types.
12.	Calculations based on Ohm's Law. Lubricants types Viscosity and effects of temperature on viscosity, High 7 detergent oil and its applications Gears and belt drives, problems on gear and belt drive.	
13.	Work energy, power- Definition and calculation of Work, Power and Work done by a torque, Definition and calculation of Energy -Potential energy, Chemical energy, Conservation of energy, Energy equation, Kinetic energy, Energy of a falling body, Kinetic energy of rotation.	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I (Duration – 110 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
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)

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

Block – I (Duration-12 months)

1. Apply safety precautions that are observed in workshop.
2. Overhaul and trouble shoot suspension, shock absorbers & its maintenance
3. Introduction of tubeless tyres & its maintenance
4. Service the brake system.
5. Replacement of brake shoes / brake pads.
6. Repair and maintenance of mechanical brake system, hydraulic disc brake system.
7. Road test for braking efficiency.
8. Overhaul clutch assembly and adjust clutch lever free play.
9. Repair automatic clutch, automatic transmission and transmission system
10. Overhaul gear box and Check vehicle noise from transmission system & identification of faults.
11. Dismantle cylinder head and decarbonising.
12. Recondition valves and valve seats, Check and adjust valve timing.
13. Remove piston and connecting rod assembly.
14. Dismantle gudgeon pins and bushes, piston-rings, cleaning, checking and refitting them.
15. Check main bearings and crankshaft, connecting rod bearings, timing chain tension and replacing worn chain.
16. Check alignment of connecting rod for twist and bend.
17. Check warping in the cylinder head & block surface, cylinder bore.
18. Reassemble of engine parts in correct sequence and set of ignition timing as per specification.
19. Remove and refit, test and service exhaust system and catalytic converter.
20. Clean petrol fuel lines, tanks & checking for leakages, smoke and setting for exhaust gas emission measurement.
21. Check and sett idle speed of petrol engine.
22. Test induction coil and condenser, Set Ignition timing, clean and checking of spark plug.
23. Electronic ignition repair and maintenance.
24. Overhaul steering, repair and alignment of chassis.
25. Maintenance of lead - acid battery, Charge battery from a battery charger.
26. Repair components in lighting circuit, testing bulbs and replacing fuse.
27. Overhaul starter motor.
28. Repair and adjust electrical horns.
29. Trouble tracing in electrical circuits using AVO meter. Digital meters & Switches.

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

MECHANIC REPAIR & MAINTENANCE OF TWO WHEELER			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1.	D.E. Spanner ()	6 to 32 mm	2 sets
2.	Ring Spanner ()	6 to 32 mm	2 sets
3.	Plier combination	200 mm, 250 mm	4 each
4.	Circlip pliers (internal and external)	150 mm	4 nos.
5.	Round nose pliers	150 mm	2 nos.
6.	Long nose pliers	150 mm, 200 mm	4 each
7.	Screw driver (II/d)	300 mm	2 each
8.	Screw driver light duty	150 mm, 200 mm, 250 mm.	2 each
9.	Star screw driver set		2 sets
10.	F/tank puller		2 nos.
11.	Monkey wrench	300 mm	2 nos.
12.	Bench vice	300 mm	2 nos.
13.	Socket wrench (long)		2 sets
14.	Socket wrench (box)		2 nos.
15.	Plug wrench		2 sets
16.	Grease gun		2 sets
17.	Allen key set		2 sets
18.	Magneto puller cot		2 sets
19.	Hacksaw frame		2 nos.
20.	Hammer (big & small)		2 each
21.	Plastic hammer		2 nos.
22.	Oil can		2 nos.
23.	File flat, round (Rough & smooth)	250mm, 300 mm	2 each
24.	Engine mounting puller		2 nos.
25.	Clutch puller		2 nos.
26.	Shock absorber puller		2 nos.
27.	Chisel		2 nos.
28.	Punch		2 nos.
29.	Snip		2 nos.
30.	Piston ring compressor and expander		1 each
31.	Piston ring puller		2 nos.
32.	Adjustable wrench	300 mm	2 nos.
33.	Pipe wrench	200 mm	2 nos.
34.	Tyre lever		2 sets.
35.	Feeler gauge	25 blades	2 nos.

36.	Caliper	150 mm inside / outside	2 nos.
37.	Steel rule	300 mm	6 nos.
38.	Vernier caliper	200 mm	2 nos.
39.	Hydrometer		2 nos.
40.	Ridge cutter		1 no.
41.	Bearing puller general		4 nos.
42.	Fire extinguisher		2 nos.
43.	Fire buckets with stand		2 no.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
44.	Scooter / Motor cycle repairing stand		1 no.
45.	Spark plug testing & cleaning machine		1 no.
46.	Gas Analyzer with temperature & speed sensor		1 no.
47.	Scooter	two stroke engine	1 no.
48.	Scooter	four stroke engine	1 no.
49.	Motor cycle	two stroke engine	1 no.
50.	Motor cycle	four stroke engine	1 no.
51.	Two wheeler lifting stand		1 set
52.	Stroscoping Timing light		1 no.
53.	Tachometer		1 no.
54.	Battery charger	Multi ampere	1 no.
D : WORKSHOP FURNITURE			
55.	Discussion Table	1 No.	1
56.	Tool Cabinet	2 Nos.	21
57.	Trainees locker	Required to accommodate 16 lockers	As required
58.	Book shelf (glass panel)	1 No.	As required.
59.	Storage Rack	2 Nos.	As required
60.	Storage shelf	2 Nos.	As required

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MECHANIC REPAIR & MAINTENANCE OF TWO WHEELER

LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

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

2) Infrastructure:

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

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

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														