CURRICULUM

FOR THE TRADE OF

CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR

UNDER

APPRENTICESHIP TRAINING SCHEME

2017

सत्यमेव जयते
Government of India

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

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1. ACKNOWLEDGEMENT

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1. Central Staff Training & Research Institute, Kolkata
2. …….
3. …….

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

Co-ordinator for the course : R.N.MANNA, Training Officer, CSTARI, Kolkata

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	Nirmalya Nath, Astt. Director of Trg.	Central Staff Training & Research Institute	Expert
2.	R.N.Manna, Training Officer	Central Staff Training & Research Institute	Expert
3.	Prasoon Ghosh	Central Staff Training & Research Institute	Expert
4.			Expert
5.			Expert
6.			Expert
7.			Expert
8.			Expert
7.			Expert
8.			Expert

2. BACKGROUND

2.1 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.

2.2 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.

2.3 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.

3. RATIONALE

(Need for Apprenticeship in CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR trade)

A Unique Training Process

The Apprenticeship system of training is unique in that it is the only formal, structured, and nationally recognized education and training program available that combines the two most common forms of career and occupational learning: classroom instruction with on-the-job training.

Apprentices not only learn occupational skills in the classroom, their learning is expanded to include hands-on, paid, on-the-job training. Students learn and practice all phases of the trade/occupation in real-world applications.

Apprenticeship is a training strategy that, leads to a certificate of completion and nationally recognized skilled worker status. These credentials have explicit meaning, recognition, and respect in the eyes of Central and State Governments and relevant Industries.

The Apprenticeship Programs train men and women to craftsman status. By participating in a program, apprenticeship training shape trainees with character, aptitude, motivation and good personality traits into competent Craftsmen and Craftswomen who have in-demand skill sets, comprehensive knowledge, positive attitudes and superior abilities.

Apprenticeship Training in this trade has the following benefits :-

1. The greater degree of relevance of the training with latest advancements of the industry will enhance the employability opportunities.

2. Ability to **Repair and Maintain Mechanical Equipment** -- Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment

3. Acquire knowledge of **Operating Vehicles, Mechanized Devices, or Equipment** -- Running, maneuvering,
4. driving vehicles or mechanized equipment, such as Mobile / Static construction Equipments like forklifts, Dozer, Dumper, Derrick crane, Stone crusher, etc.

5. Acquire knowledge of **Updating and Using Relevant Knowledge** -- Keeping up-to-date technically and applying new knowledge to own job.

6. **Ability to Inspect Equipment, Structures, or Material** -- Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

7. **Ability to Communicate with Supervisors, Peers, or Subordinates** -- Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.

8. Acquire knowledge of **Organizing, Planning, and Prioritizing Work** -- Developing specific goals and plans to prioritize, organize, and accomplish your work.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

1) Test mechanical products and equipment after repair or assembly to ensure proper performance and compliance with manufacturers' specifications.

2) Repair and replace damaged or worn parts.

3) Operate and inspect machines or heavy equipment in order to diagnose defects.

4) Diagnose faults or malfunctions to determine required repairs, using engine diagnostic equipment such as test equipment and calibration devices.

5) Dismantle and reassemble heavy equipment using hoists and hand tools.

6) Clean, lubricate, and perform other routine maintenance work on equipment and vehicles.

7) Examine parts for damage or excessive wear, using measuring instruments and gauges.

8) Schedule maintenance for industrial machines and equipment, and keep equipment service records.

9) Read and understand operating manuals, blueprints, and technical drawings.

10) Assemble gear systems, and align frames and gears.

11) Fit bearings to adjust, repair, or overhaul mobile mechanical, hydraulic, and pneumatic equipment.

12) Weld or solder broken parts and structural members, using electric or gas welders and soldering tools.

13) Clean parts by spraying them with grease solvent or immersing them in tanks of solvent.

14) Adjust, maintain, and repair or replace subassemblies, such as transmissions and crawler heads, using hand tools, jacks, and cranes.

15) Adjust and maintain industrial machinery, using control and regulating devices.

16) Direct workers who are assembling or disassembling equipment or cleaning parts.

Reference NCO: **7233.90, 7233.30, 7233.28, 8332**

5. GENERAL INFORMATION

1. **Name of the Trade** : **CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR**

2. **N.C.O. Code No.** : **7233.90, 7233.30, 7233.28, 8332**

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

3.1 **For Fresher's :- Duration of Basic Training**: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: 6 months

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

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

3.2 **For ITI Passed :- Duration of Basic Training**: - NIL

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

4. **Entry Qualification** : Passed 10th Class under 10+2 system

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

8. Rebate to ITI Passed out Trainees : One year for the trade of **Mechanic Motor Vehicle.**

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

6. COURSE STRUCTURE

Training duration details: -

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

[Please do not make any changes in the course structure]

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

[Please do not make any changes in this page]

7. SYLLABUS

7.1 BASIC TRAINING

(BLOCK – I & II)

DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR**

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

3) **Batch size** : 16

4) **Power Norms** : 10 KW for Workshop

5) **Space Norms** : 200 Sq.mt.

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

7) **Instructor Qualification** :

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

OR

ii) NTC/NAC in the trade of **CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR** with three year post qualification experience in the relevant field.

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

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

[May suggest for any change]

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	Engineering Drawing	Duration (in hours)	Workshop Calculation Workshop Science	Duration (in hours)
1	• Free hand sketching with dimensions and proportionate sketching of circles, rectangles squares, parallelograms rhombus & polygons. • sketching of simple solids such as cubes, prisms, cylinders, cones, hollow objects, etc.	30	• Fraction and Decimal- addition, subtraction, multiplication and division L.C.M., H.C.M., Conversion of fraction to decimal and vice versa. Simple shop problems.	**20**
2	• Free hand sketching of nuts, bolts, studs, Rivets, Screws, Washers, locking devices of different types with dimensions from samples. • Sketching of riveted joints (lap and butt joints).		• Properties of ferrous metals-cast iron, wrought iron, plain and high carbon steel-high speed steel and alloy steel etc. and their uses.	
3	• Free hand sketching of tyres and wheels, front spring assembly and shock absorber, front axle assembly, steering linkages		• Properties of non-ferrous metals, copper, zinc, lead, tin, brass, aluminum, bronze solder & bearing metals and their uses.	
4	• Exercises in simple orthographic peojection-3rd angle projection (stepped and taper blocks), • Free hand sketching of different types of steering boxes, caster, chamber, king pin inclination Ackerman's angle, toe-out		• Metric system- metric weight and Length measurement, units used-conversion from FPS to metric system and vice versa. • Shop problem involving metric and British system.	
5	• Free hand sketching of brake linkages, wheel brake assembly, sectional views of master cylinder, brake wheel cylinders-cam adjuster, brake shoe assembly and anchor pins.		• Meaning of tenacity, elasticity, hardness, compressibility and ductility-examples of each. • Effect of alloying elements and properties of cast iron and steel alloys.	
6	• Free hand sketching of vacuum boosters-sketching the layout of vacuum assisted-hydraulic braking system, air brake system and sketching of slacke adjuster		• Levers and Simple Machines:- Levers and its types, Simple machines, Efforts and load, Mechanical advantage, Velocity ratio, Efficiency of	

			machine, Relationship between efficiency, Velocity ratio and Mechanical advantage. problem related to levers as applied to motor vehicles.
7	• Isometric drawings of simple objects such as square and rectangular blocks with grooves and key ways. • Isometric view of clutch pedal-clutch release bearing-fork and clutch assembly.		• friction-examples of useful and wasteful friction in vehicles. Co-efficient of friction-simple problem on friction. • Problems in steering geometry, calculation of caster & chamber.
8	• Free hand sketching of the arrangement of gears inside the mesh gear box in different gear boxes, shifter mechanism and gear shift lever. • Free hand sketching of different types of rear axles, universal joints, silencer brackets.		• Work-done, energy and power –their units -Torque and its relation to forces – related shop problems. • Explanation of horse-power brake horse power and indicated-horse power, Mechanical efficiency, electrical equivalent of Horse Power.
9	• Free hand sketching of 4 stroke cycles and 2 stroke cycles. • Drawing the 3 views in 3rd angle projection of a tapered hollow object, curved object.		• Ratios and proportions-simple problems. Gear ratios in gear box and gear axles. • Percentage:- Simple trade related calculation, changing percentage to decimal and fraction and vice versa.
10	• Freehand sketching of oil filters – oil flow circuits – oil pumps. • Exercises in Blue print reading. • Free hand sketching of electrical symbols and drawing of simple electrical circuits.		• Calculation of perimeter and areas of square, rectangles, triangles, circles and regular polygons. • Calculation of volumes and weight of rectangular, cylinders (solid and hollow) and conical blocks,

[Please check course content for both E/D & WSc.. May suggest for any change]

B. Block- II
Basic Training

Topic No.	Engineering Drawing	Duration (in hours)	Workshop Science & Calculation	Duration (in hours)
1	• Free hand sketching of ignition circuit of a vehicle. • sketching the circuit line diagram of magneto ignition, charging system.	30	Speed and Velocity:- Rest and motion, Speed, Velocity, Acceleration, Retardation, Equation, of motion, Simple related problems.	20
2	• Sketching starter motor circuit and solenoid switch circuit, various electronics devices used in motor vehicles.		Heat and Temperature:- Definition of heat and temperature and their units, difference between heat and temperature. Scale of temperature, boiling point, melting point, relation between different scales of temperature.	
3	• Freehand sketching valve operating mechanism, piston and connecting rod, oil pump. • Drawing of different types of couplings, bearings pulleys.		Basic Electricity:- Introduction, Use of Electricity, Types of currents, AC, DC, their comparison, Voltage, Resistance, their units, Conductor, Insulators, Types of connection - series, parallel, electric power, energy, unit of electrical energy.	
4	• Freehand sketching of sectioned view of silencer box – exhaust pipes and tail pipe. • Freehand sketching of combustion chambers of different types.		Electrical Circuits, Types of circuits, Definition of ampere volt and Ohm-units of current, voltage and resistance-Ohm's Law. Calculations based on Ohm's Law. Measuring instruments – voltmeter, ammeter, ohmmeter, megger & wattmeter. batteries, magnets and electro-magnet-working of DC & AC motors.	
5	• Freehand sketching of fuel feed system in diesel engines, fuel injectors of different types and diesel fuel filters.		Algebra:- Addition, Subtraction, Multiplication, Division, Algebric formula, Linear Equations (with two variables)	
6	• Freehand sketching of light circuit of vehicle with electrical symbols. • Freehand sketching of horn circuit, drawing the sectional view of horn		Trigonometry:- Trigonometrical ratio, measurement of angles, Height & distance – related shop problems	

7	• Freehand sketching of wiper motor circuit. • Sketching the flasher light circuit with symbols.		Centre of gravity-examples-problems involving centre of gravity in vehicles. Inclined plane, its uses-example and applied problems.
8	• Freehand sketching of magneto ignition circuit. • Freehand sketching of alternators charging unit.		Reading of simple graphs. Plotting and reading of graphs.
9	• Freehand sketching of brake plate assembly and advance and retard plate. • Freehand sketching of the complete wiring of the vehicle.		Meaning of stress, strain, modules of elasticity, ultimate stress, factor of safety, examples of different types of stresses – related problems.
10	• Freehand sketching of synchromesh unit. • Freehand sketching of intermediate shift and shifter arrangement.		Hydraulics-elementary principles-incompressibility of liquids-Pascal's Law and Archimedean principles, law of flotation-problem involving properties of fluids.

[Please check the course content for both E/D & WSc. may suggest for any change]

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skill (275 hrs.)	Professional Knowledge (120 hrs.)
1	• Description of safety equipment, their use, safety rules to be observed in an Auto-mobile repair shop. • Accident & their causes. Up keep of fire extinguishers. Familiarization of the tools and machinery available in the shop-their use and up keep. Importance of cleanliness of work-spot, tools, jacks and trays, etc.	• Importance of safety & general precautions to be observed in the shop. Fire extinguishers used for different types of fire. Storing and handling of inflammable materials. Elementary first Aid
ALLIED TRADE – FITTING AND WELDING WORK		
2	• Demonstration and use of fitters hand tools-marking off with steel rule, calipers, scriber, divider, dot punch & centre punch. Chipping on marked lines. Sharpening of chisels, centre punch, dot punch for correct angles. • Hack sawing and filling to given dimensions. Filling true and square. Different types of filling operations.	• Tools used in marking-steel rule, dividers, scriber, prick and centre punch, hammer and chisel. Their uses and maintenance. Safety precautions in handling grinding machines. • Types of hacksaw frames & blades-their selection and uses. Types of files and their uses. Care & maintenance of files.
3	• Marking and drilling clear and blind holes, safety precautions to be observed while drilling. Tapping a clear and blind hole. Adjustment of two-piece die-reaming a bush to suit the given the pin/shaft. Scraping a given machine surface • Measuring diameter of pistons, main-journals, crank pins, big and main bearings, cylinder bores, with micrometers & vernier calipers, measuring width and thickness of machined flat and round bars-measuring of valve angles with protractor head-locating of a round bar with centre head.	• Types & sizes of drills. Cutting angles and speed and feed of drills. Calculation of tap drill sizes. Taps & dies-description and use of different types of taps & dies. Use of "V" threads. Precautions while using taps & dies. Description and use of different types of scrapers, reamers & emery papers. • Construction and method of reading micrometer (Internal & External) & vernier calipers. Correct handling of micrometers and vernier calipers. Reading of vernier scale. Description and use of combination set vernier bevel protractor. Care and maintenance of micrometers, vernier calipers, combination set etc.
4	• Arc & Gas welding, oxyacetylene cutting. • Brazing and soldering.	• **Welding equipment:** Welding transformer/generator, Submerged arc-welding, Electrostatic/electroslag welder machine, Automatic welding, Diesel welding machine, Gas & electric arc welding, Oxy-acetylene cutting machine.

SERVICING AND LUBRICATION WORK		
5	• General servicing of vehicles-washing of Vehicle-washing, cleaning, oiling, greasing and lubrication. • Inspection of under carriage of vehicle-tightening all loose bolts and nuts. • Use of hydraulic jacks, hoist and horses. Select materials for packing, cutting and use of common locking devices such as lock nuts, cotter and split pins, rivets, key, circlips, lock-rings, lock-washers, wire locking and locating where these are used. Use of modern locking devices such as engineering Adhesives and chemicals.	• General description of motor vehicles. Major Assemblies – Description, location and function of each. Details of diesel & petrol vehicles and battery operated vehicle. • Different locking methods and devices used in vehicles, Hydraulic and screw jacks, hydraulic hoist and air compressor their description and uses. • Modern locking devices and their uses. • Type, grade & application of various types of oil and lubricants used for maintenance. i. Grease. ii. Cardium compound. iii. Engine oil. iv. Gear oil. v. Brake oil. vi. Hydraulic oil.
SUSPENSION AND STEERING WORK		
6	• Removing wheels from vehicles, dismantling tyres and tubes – Checking and repairing punctures in tubes, assembling, inflating to correct pressure, rotating the wheel in a vehicle. Minor repairing of wheels and tyres. • Inspecting the frame-checking alignment of frame-servicing of spring-replacing new bushes for shackle pins. Changing bushes in shock absorbers-cleaning and lubrication of wheel bearing, adjusting wheel bearings • Removing kingpins and bushes, replacing new bushes and pins-after reaming and lubrication of king pin bushes, changing Huber bushes in the front independent suspension system.	• Description of wheel and tyres – types – selection of tyres, ply rating, inflation pressure and carrying capacity, storage of tyres. • Frames-description and function. Common trouble in conventional suspension system. Types of leaf springs. Different types of shock absorbers-their description, operation and maintenance. • Description of different types of independent suspension system-special features in each system. Maintenance and lubrication of front suspension system. • Machine element: **a. Shaft** – Rigid, Flexible, Keyways, Spline, Tapper Hub. **b. Bearings** – Restrain – Radial, Axial. Composite support – Rigid, Flexible, Self-Aligned, function – Multiple bush (bronze), Non-metalic (PTEF) **c. Couplings** – Rigid, Flexible. **d. Clutches** – Jaw, Friction, Fluid, Centrifugal. **e. Antifriction bearing** – Ball, Tapper roller, Spherical roller cage.

7	• Inspect and overhaul front and rear suspension-rear springs, coil springs-torsion bars. Check up of dead axle for alignment. • Inspect and adjust steering linkages, after replacement of worn parts. Alignment of steering wheels with respect to front wheel. • Inspect and overhaul steering boxes-adjusting, steering gear back-lash & end play. Check & adjust toe-in, chamber angles. Checking king pin inclination and caster angle with special gauges.	• The front axle-description and functions, types of steering knuckles, arrangement of steering knuckle joint, general layout of steering linkages. • Description of different types of steering boxes-special features of each, adjustments repair & maintenance of steering-description and its advantages. • Description of Ackerman's angle, caster, chamber, toe-in & toe-out on turn, purpose and effect of these angles.
BRAKE WORK		
8	• Adjusting brake pedal play. Dismantling wheel brake assembly-cleaning and inspecting-adjusting, brake shoes for proper clearance. Bleeding hydraulic brakes. • Removing master cylinder-dismantling, cleaning and inspection of parts-assembling and testing-bleeding the braking system after cleaning the pipe lines.	• Arrangement of brakes cars and trucks-description of hand brake and its purpose. Layout of mechanical and hydraulic braking system in cars. • Master cylinders-types including the tandem master cylinder, special features of each function-common troubles and remedy.
9	• Dismantling wheel brake assembly-removing old lining and fitting, new lining on the brake shoe. Removing & cleaning of brake drums. Inspecting wheel cylinders and brake drums-fitting new cups and brake hosepipe-reassembling. Adjusting wheel bearings and testing & adjusting all 4 wheel brakes. precautions to be observed while testing brakes. Points to remember while preparing the vehicle for brake certificate. • Trouble tracing and adjusting air brakes-repairs to tank unit, air compressor, wheel brake adjusters-locating air brakes in the brake lines and rectifying-general maintenance and care.	• Brake lining-types, uses-relining the brake shoes-precautions to be observed. Wheel cylinders-descriptions, function and types. Brakes fluids-description and use, types of fluids used. • Description of air brake system-major components in system, purpose of each part, their care and maintenance-troubles in air brake assembly and their remedy. • Brake testing-efficiency of brakes-braking distance, common troubles in brakes and their remedy
TRANSMISSION WORK		
10	• Adjusting clutch pedal play removing gear box and clutch assembly from vehicle. Dismantling clutch assembly cleaning and inspecting parts. • Removing and fitting of ring gear in fly wheel. Relining a clutch plate-checking condition of flywheel and pressure plate surface for reconditioning. • Assembling of pressure plate-adjusting the fingers-checking run out of flywheel and aligning clutch assembly with flywheel.	• Power Transmission: **a.** **Belt** – (Flat, V-belt) **b.** **Pulley** – Various types including multi sheeve. **c.** **Gears** – Spur, Belical, Bevel Warm, Rack & Pinion. **d.** **Chain** – Simple, Duplex. **e.** **Screw** – Square, Saw tooth. **f.** **Spring** – Compression, Tension, Leaf, Disc. **g.** **Fastener** – bolts, Rivets. • Layout of transmission system,

		description of single plate clutch and multiple plate clutches functions different types of clutches used in vehicles-their description, special features and advantage. • Clutch linings-types-materials used bonded and riveted lining clutch plate construction, purpose of damper spring-precautions while lining/clutch plate.
11	• Dismantling a four speed sliding mesh gear box. Cleaning –inspection of parts for wear/damage. Assembling the gear box and filling in oil. • Removing open type propeller shaft from vehicle. Removing universal joints-cleaning, inspecting-replacing of worn out parts, reassembling and fitting to vehicle. Special precautions while removing torque tube driver shaft.	• The purpose of gear box in vehicle-description and functions of a sliding mesh gear box-common troubles in gear box and their remedies. • Lubrication of gear box, constant mesh gear box description and advantages. • open and closed type propeller shaft. Types of universal joints-care and maintenance, constant velocity joints-special features and advantages.
12	• Removing rear brake drums and adjusting the wheel bearings in full floating rear axles and semi-floating axles-replacing oil seals in rear axles. • Removing rear axles assembly from vehicle, dismantling, cleaning, inspecting parts for wear and damage, cutting packing/gaskets, removing tail pinion and bearings-cleaning and inspection of oil seals and bearings.	• Description and purpose of different types of rear axles-special features and advantages of each type, lubrications of rear axles-reasons for oil in brake drums. • Description and functions of final drive assembly-crown wheel and tail pinion-hypoid gear and its lubrication. Description of differential and its principle of operation.
13	• Checking tooth contact in crown and pinion and adjusting backlash. Assembling the rear axle and fitting rear axle assembly on vehicles and testing. • Trouble shooting in the transmission system of vehicle-detecting noises from clutch, gear box, universal joints and rear axles assembly, dismantling, transfer case from vehicle-cleaning, inspecting, replacing worn parts, reassembling and fitting to vehicle.	• Description and function of differential gears-types-tooth contact and backlash, preloading adjustment. Common troubles and their remedy in rear axle assembly. • Description and purpose of optional fittings such as transfer case-free wheel-power take off-common troubles in these units and their remedy-care and maintenance.
	Internal Assessment 03 days	

[Please check the course content for both E/D & WSc. may suggest for any change]

B. Block –II
Basic Training

Week No.	Professional Skill (275 hrs.)	Professional Knowledge (120 hrs.)
PRELIMINARY ENGINE WORK		
1	• Dismantling of unserviceable engine-cleaning, studying the parts in the engine, studying valve operating mechanism and assembling the engine, practice in the use of correct tools and right procedure.	• Description of internal and external combustion engines, different types of I.C. engines, important working parts in the engine the 4 stroke cycle. • Two stroke cycle, difference between 4 stroke and 2 stroke cycle engines. Description of valve operating mechanism and valve timing. Description and function of valve spring, guide, tape etc., valve seals and locks.
2	• Checking compression pressure in a running engine, dismantling the cylinder head from the engine, removing the valves, cleaning, reassembling and adjusting tape etc. • Removing pistons and connecting rods from engine dismantling, cleaning, inspecting, checking clearances, installing rings and piston pins. • Removing connecting rod assembly-cleaning, checking bearing clearness, replacing bearing shells, setting correct clearness, measuring wear in crank pins and main journals in crank shaft.	• Description and function of cylinder block, cylinder head cylinder liners. Reconditioning of cylinder heads. • Description and functions of different types of pistons, pistons rings and piston pins-common troubles and remedy. • Description and function of connecting rod, materials used for connecting rods-big end and main bearings shells-piston pins and locking methods of piston pins. Crank shaft-description, function and types. Common troubles and remedies.
3	• Assembling crankshaft, main bearings, connecting rods and piston assembly in the engine. Fitting cylinder head and starting the engine and tuning up engine for smooth, slow speed running. • Checking cooling system for overheating: cleaning, radiators, dismantling, cleaning, assembling and testing water pumps, reverse flushing the system and adjusting the fan belt tension. • Studying the lubrication, oil flow system in engine. Overhauling oil filters, oil pump and setting the pressure release valve for correct oil pressure. Maintenance and repair in	• Firing order of the engine. Crank shaft balancing. Description of the fly wheel and its function, crank case and oil sump. • Engine cooling methods, Air and water cooling radiators, pump thermostats and fans, their description: care and maintenance. Reasons for engine overheating. • Need for lubrication of engine parts – friction, lubrication and its properties, lubrication system, types – full flow and by-pass flow system, components in lubrication system, oil filters and pumps – types, their special features and uses.

	the lubrication system in engine.	
ELECTRICAL/ ELECTRONIC ACCESSORIES REPAIR WORK		
4	• Join wires by soldering. Forming simple electrical circuits. Measuring of current, voltage and resistance. Cleaning and topping up of a lead acid battery. Testing battery with hydrometer. Cell tester. Connect battery to charger. Battery maintenance. • Studying electrical circuits in the engine assembly, checking loose, open and short circuit in ignition circuits. Cleaning and testing spark plugs. Overhauling of distributor assembly. Checking and setting ignition timing.	• Simple electrical circuits, series and parallel circuits. Identification of alternating current and direct current meters. Insulators, conductors, types of resistances-Ohm's Law and its application. Common electrical terms and symbols-primary and secondary cells-lead acid battery-description-construction-common troubles and remedies. • Description of electrical circuits-ignition system and the components-purpose of induction coil, condenser, spark plugs. Common troubles in ignition circuit and remedies.
5	• Removing dynamo from vehicle dismantling, cleaning, checking for defects-assembling and testing of motoring action of dynamo and fitting to vehicle. • Removing starter motor from vehicle and overhauling the starter motor-testing of starter motor. • Identification of different electronic device, fault finding in electronic circuits and remedies.	• Description of charging circuits-operation of dynamo and regulator unit-ignition lamp-trouble and remedy in charging system. • Description of starter motor circuit-constructional details of starter motor. Solenoid switches. Common troubles and remedies in starter circuits. • Introduction to electronics- resister, capacitor and inductor and their principles of working. Different types of diodes, transistors, power supply for electronic circuit.
6	• Studying the light circuit – test bulbs, align head lamps, find out short and open circuits in the light wiring – replacing fuses testing the tail and brake lights in vehicle. • Removing an electrical horn from vehicle – dismantling, cleaning point, testing wires, assembling the horn and adjusting the horn for correct sound, tuning double horn, repairing of horn relay and horn switches.	• Description light circuits – different components in light circuits – description and function of each. Refocused bulbs and scaled beams. Fuses and their important. • Electric horn circuit – description of electric horn – operation of relay and horn switches. Common troubles and their remedies.

7	• Removing a wiper motor-dismantling, cleaning, inspecting, repairing of electrical motors, assembling and fitting, setting blades for correct functioning. • Signal flasher light circuit – tracing defects in the flasher circuits replacing fuse bulb. • Removing dismantling cleaning and assembling magnetos – adjusting gap in points – testing magnetos.	• Description and operation of an electric wiper motor, care and maintenance. Common trouble and remedies. • Flasher circuit, its description and operation, common troubles in the circuit and remedies. • Magneto ignition system – description and operation, advantages – rotating armature and flywheel magneto – special features.
DRIVING PRACTICE		
8	Practice in straight driving on vide road. Driving through lanes and curves. Practice in reversing, overtaking another vehicles. Practice in driving through sand and wet surface. Practice in parking vehicles, parallel parking and diagonal parking. Practice in driving over slopes and downhill. Practice in driving over narrow brides.	Motor vehicle Act – driving road rules – road traffic signals – hand signals. Precautions to be taken while overtaking, reversing driving through narrow lanes, curves and slopes.
FUEL FEED SYSTEM		
9	• Bleeding fuel lines for air locks. Repairing fuel leaks in the pipe lines and unions. Cleaning of oil and air filters in diesel engines. • Cleaning and servicing of primary fuel filters and pressure stage filters-removing feed pump-dismantling, cleaning, reassembling, refitting and testing the feed pump. • Dismantling an unserviceable fuel injection pump clearing, inspecting, studying parts and reassembling. Removing G.I. pump from running engine changing oil in it-timing back to engine-testing the governor and setting injection timing.	• Fuels used in diesel engines specifications of diesel fuels, importance of clean fuels, general layout of the fuel feed system in the stationary and transport diesel engines. • Types of fuel injection systems-air injection and air less injection. Fuel feed pumps-description operation-common troubles and remedies. • Need for governors-types-pneumatic and mechanical governors. The pumps-phasing and calibration of pumps. Checking and fixing injection timings. Governors-types, their description and operation. Starting and adjusting slow speed.
10	• Testing injectors for missing on the vehicle-removing, dismantling, cleaning, inspecting-replacing defective parts-reassembling the injectors and testing them. • Adjustments in the fuel feed system – checking exhaust gases – and adjusting the governor-slow speed adjustment	• Injector nozzles-types, description, operation, testing of injectors. Special features of pintle nozzles. • Need for governors – types – pneumatic and mechanical governors, maintain of governors, reasons for black, white and blue smoke in exhaust.

	and venture control adjustments. Checking oil, fuel, water and exhaust gas leaks and correcting them.	
SYNCHROMESH GEAR BOX AND TRANSFER CASE 4 WHEEL DRIVE AND WORK		
11	• Dismantling a synchromesh gear box-cleaning, inspection parts replacing worn out defective parts – assembling and testing for correct performance, identifying noises from gear boxes and rectifying. • Removing transfer case from the vehicle – dismantling, cleaning inspecting parts, replacing worn/damaged parts, reassembling, testing and fitting. Repairing of four wheel drive shifter mechanism. Overhauling of front wheel drive propeller shaft unit.	• Synchromesh gear boxes – advantages – description, operation in different gear positions. Common troubles and remedies types of synchromesh gear boxes – their special features. • Description and operation of four wheel drive – the purpose of transfer case and the arrangement of shifting mechanism. Common troubles and remedies.
12	• Wheel balancing and use of equipments. • Fault and diagnosis of hydraulic system in use for construction machineries. • Repair, maintenance and adjustments of power control unit.	• Importance of wheel balancing. Details of equipments and method. • Components of hydraulic system and their function – pump, control valves, cylinder etc.
13	• Operation, fault finding and maintenance of minimum two nos. of the Construction Equipment as available in the Institute.	General information, description, concept of capacity/output, safe application and uses of the following construction equipment as subdivided into various groups. **a. Heavy Earth moving equipment:** Dozer, Dumper, Tipper, Hydraulic Excavator, Pay loader, Front loader, Front end Loader cum excavator, Scrapper, Dragline, Grab. **b. Road making equipment:** Motor Grader, Vibro roller/compactor, Road roller, water tanker, Hot mix plant, paver finisher, Bitumin mixer, Mortar mixer, Sheep foot roller. **c. Aggregate production equipment:** Various types of stone crusher (Jaw, Gyratory, Ball, Roller, Hammer), Screen feeders, Scrubbers, Classifier. **d. Concreting equipment:** Batching plant, Concrete mixer, Transit mixer, Concrete pump, Vibrators. **e. Erection/Lifting equipment:**

		Winches, Hoist (Material/Personal), Crawler, Crane, Hydraulic crane, Tower crane, Derrick crane, Gantry crane. **f. Pneumatic equipment:** Compressor, Drill, Hammer, Vibrator, Rock drill, Pavement breaker, Wagon drill. **g. Transporting equipment:** Truck, Trailor, and Tractor.
	Internal Assessment 03 days	

[Please check the course content for both E/D & WSc. may suggest for any change]

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1) **Name of the subject** : **EMPLOYABILITY SKILLS**

2) **Applicability** : ATS- Mandatory for fresher only

3) **Hours of Instruction** : **110 Hrs. (55 hrs. in each block)**

4) **Examination** : The examination will be held at the end of two years Training by NCVT.

5) **Instructor Qualification** :

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

And

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

OR

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

[Please do not make any changes in this page]

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**Speaking / Spoken English** Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**Computer Operating System** Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and	

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

[Please do not make any changes in the Employability Skill syllabus]

B. Block– II
Basic Training

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

2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision legislation of India. of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.	
	Quality Tools	**5**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**Quality Circles :** Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

[Please do not make any changes in the Employability Skill syllabus]

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

GENERAL INFORMATION

1) **Name of the Trade** : **CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR**

2) **Duration of On-Job Training** : a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

3) **Batch size** : a)Selection of Apprentices as per apprenticeship guidelines.

b) Max. 16 trainees per group

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

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

5) **Instructor Qualification** :

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

ii) NTC/NAC in the trade of **CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR** with three year post qualification experience in the relevant field.

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

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

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

A. BLOCK – I

1. Washing, cleaning and servicing of Vehicle - washing, cleaning, oiling, greasing and lubrication.
2. Repair parts by filing, drilling, threading (tap & die), reaming, welding (gas & arc), grinding, etc.
3. Repair suspension system and steering system. Replace worn out kingpins and bushes in front axle assembly.
4. Align front wheel and do necessary adjustments using different types of gauges.
5. Dismantle, inspect, repair and assemble the brake assembly.
6. Adjust and bleed the hydraulic brake. Overhaul the master cylinder and do bleeding vacuum assisted hydraulic brake.
7. Trace out faults and rectify / repair and adjust air brake.
8. Do relining of clutch plate and adjust clutch paddle free play.
9. Repair defects in clutch assembly, gear box, universal joint and rear axle.
10. Identity defects and noises in the transmission system and rectify. Overhaul differential gears and adjust and check Backlash.

B. BLOCK – II

1. Dismantle and assemble of different components of the engine.
2. Repair engine, valve re-facing, valve seat cutting, de-carbonizing, fitting of bearings, piston rings, gudgeon pins.
3. Overhaul water pump, oil pump and petrol pump.
4. Find troubles / faults and rectify in cooling, lubrication and fuel feed system of the engine.
5. Clean, test and charge battery.
6. Find faults and rectify defects in wiring circuits, making wire connections and soldering, forming series and parallel circuits.
7. Overhaul Dynamo self starter.
8. Find faults in electrical circuit and accessories - rectify and overhaul.
9. Drive and road test a motor vehicle following necessary safety rules.
10. Check and correct fuel leak and service diesel fuel filters, bleed air in the diesel fuel system.
11. Remove, clean and test fuel injector and find out the defective/missing injector.
12. Overhaul fuel feed pump. Check and correct injection timing in single and multi-cylinder engine.
13. Overhaul a synchromesh gear box, transfer case.
14. Operation, fault finding, repair and maintenance of minimum SIX Nos of the Construction Equipment at least TWO from each group as sub-divided below:-

<u>MOBILE CONSTRCUCTION EQUIPMENT</u>

Dozer, Dumper, Tipper, hydraulic Excavator, Pay loader, Front End loader, Front End loader-cum-Excavator, Dragline, Grab, Motor Grader, Vibro Roller/Compactor, Road Roller, Water tanker,

Transit Mixer, Crawler Crane, Hydraulic Crane, Gantry Crane, Tractor, Truck, Trailer & Tractor Trailer.

STATIC CONSTRUCTION EQUIPMENT

Stone Crusher (Jaw/Gyratory/Ball/Roller), Screen Feeder, Scrubbers, Classifiers, Winches, Hoist, Derrick Crane, Compressor, Pneumatic Drill/Vibrator/Rock Drill/Pavement Breaker/Wagon Drill, Welding Transformer/Welding Generator, Submerged Arc Welding Machine, Electrostatic/Electros lag Welding Machine, Automatic Welding Machine, Diesel Welding Machine, Gas & Electric Arc Welding, Oxyacetylene cutting Machine, Batching Plant, Concrete Mixer, Concrete Pump, Concrete Vibrator, Weigh Batcher, Dewatering Pump, Hot Mix Plant, Paver Finisher, Bitumen Mixer.

[Please check the broad skill sets to be covered during the on-job training. may suggest for any change]

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

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

The following marking pattern to be adopted while assessing:

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

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

In this work there is evidence of:

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

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

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

In this work there is evidence of:

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

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

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

In this work there is evidence of:

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

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

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

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

9. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (Lateral entry). [Applicable for candidates only who undergone ATS after CTS]

- On successful completion of the course trainees can opt for CITS course.

Employment opportunities:

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

1. Building & Construction Industries.
2. Roads & Bridges Construction Industries.
3. Service and repair industries of construction machinery.
3. In public sector (Central and State) and private industries of related field in India & abroad.
4. Self employment

[May make changes in the above content as per trade requirement, if necessary]

ANNEXURE – I

10. TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: **CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR**

LIST OF TOOLS & EQUIPMENTS FOR 16 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Hammer Ball pein 0.75 kg	16 nos.
2.	Chisel cold flat 19 mm	16 nos.
3.	Centre punch 10mm dia X 100 mm	16 nos.
4.	Steel rule 15 cm English and Metric	16 nos.
5.	Screw Driver 30 cm X 9 m blade	16 nos.
6.	Screw Driver 20 cm X 9 m blade	16 nos.
7.	Spanner DE set of 12 pieces (8mm – 32mm)	16 nos.
8.	Pliers combination 15 cm	16 nos.
9.	Hand file 20 cm second cut	16 nos.
10.	Feeler gauge 20 blades (metric)	16 nos.
11.	Ring spanner set of 12 pieces (8mm-32mm)	16 nos.
12.	Steel tool box with lock and key (folding type) size 400mm X 200mm X 150mm	16 nos.

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name & Description of Machines	Quantity (indicative)
1.	Allen key set of 12 pcs. (2mm-14mm)	4 sets
2	Circlips pliers (Ext. & Int.) 150mm and 200mm (two each)	8 sets
3	Philips screw driver type set of 5 pieces 100mm – 300mm	4 sets

4	Rule steel 300 mm	2 nos.
5	Divider spring joint 150 mm	2 nos.
6	Prick punch 15cm	2 nos.
7	Chisel cross cut 200 mm X 6mm	1 no.
8	Hammer 1 kg with handle	1 no.
9	Engineers square 15 cm blade	2 nos.
10	Scriber 15 cm	2 nos.
11	Scriber block universal	1 no.
12	Marking table 90 X 60 X 90 cm (high)	1 no.
13	Surface plate 60 X 60 cm	1 no.
14	Hacksaw frame adjustable for 20-30 cm blade	1 no.
15	'V' block 75X38 mm pair with clamps	4 nos.
16	Punch, Hollow, 6, 7, 8, 9, 10.5 and 12 mm set	2 nos.
17	Punch Number set 3 mm	1 set
18	Punch letter set 3 mm	1 set
19	Hand vice 37 mm	1 set
20	Screw driver electrician type 15 cm size	2 nos.
21	File flat 30 cm bastard	2 nos.
22	File flat 25 cm second cut	2 nos.
23	File flat 20 cm smooth	2 nos.
24	File flat safe edge 25 cm smooth	2 nos.
25	File triangular 15 cm second cut	2 nos.
26	File square 30 cm rough	2 nos.
27	File half round 20 cm second cut	2 nos.
28	File square 30 cm second cut	2 nos.
29	Twist drill metric 3mm to 2mm (1mm step)	2 nos.
30	Taps and dies complete set – M6, M8, M10, M12 metric with handle	1 set
31	Hand reamer, adjustable 10.5mm to 11.25mm, 11.25mm to 12.75mm, 12.75mm to 14.25mm and 14.25mm to 15.75mm	2 sets
32	Scraper flat 25 cm	1 set
33	Scraper triangular 25 cm	1 no.
34	Scraper half round 25 cm	1 no.
35	Set of morse socket MT – 0-1, 1-2, 2-3	1 set
36	Micrometer outside 25-50mm	1 no.
37	Micrometer outside 0-25 mm	1 no.
38	Micrometer outside 50-75mm	1 no.
39	Micrometer outside 15-100mm	1 no.
40	Micrometer inside 25-50mm, 50-75mm, 75-100mm	1 no. each

41	Vernier caliper 150 mm inside, outside, depth	1 no.
42	Safety goggles	2 pairs
43	Mallet (wooden)	1 no.
44	Trammel 30 cm	1 no.
45	Blow lamp 0.5 liter	1 no.
46	Soldering iron 120 watts	2 nos.
47	Soldering copper 225 gm (fire heated) 150mm and 200mm	2 nos.
48	Pliers nose (round and straight) 150mm and 200mm	2 each
49	Snip straight 250mm	1 no.
50	Spanners double ended set of 12 metric sizes 6 to 8 to 32 mm	1 set
51	Spanner - off-set double ended set 7pcs (6mm to 17mm)	1 set
52	Double open ended ignition spanner set of 5 (6 to 9mm)	4 sets
53	Spanner adjustable 20cm	1 no.
54	Spanner ring offset set of 6 (SAE)	1 set
55	Spanner for sparking plug 14 mm	1 set
56	Magneto spanner set of 8 spanners	1 set
57	Spanner socket set 8-32 mm sockets (complete set)	2 nos.
58	Spanner T flax for screwing up and unscrewing in inaccessible position	1 no.
59	Double open ended tappet spanner	1 set
60	Drift copper 10mm dia X 150mm	2 nos.
61	Spray gun	1 no.
62	Pressure grease gun	1 no.
63	Chain pulley block 3 ton capacity	1 no.
64	Tray cleaning 45 X 30 cm	16 nos.
65	Oil can 0.5 liter	1 no.
66	Lifter valve spring	1 no.
67	Tool valve grinding suction type (consumable tool)	6 nos.
68	Valve seat cutting tools complete with guide and pilot bar (all angles) in a box	1 set
69	Extractor, stud ‘Ezy out’ type	1 no.
70	Compression gauge to read 17.6 kg/sec.	1 no.
71	Vacuum gauge 0 to 75 cm	1 no.
72	Stone carborandum 15X5X3.75cm rough and smooth	2 nos.
73	Cylinder dial gauge	1 set
74	Torque wrench (0-67.5 kg-meter) set of 3	1 no.

75	Work bench 240 X 120 X 75 cm with 4 vices 12.45 cm jaw	4 nos.
76	Lockers with 8 drawers (standard size)	2 nos.
77	Metal rack 180 X 150 X 45 cm	1 no.
78	Fuel pump	2 nos.
79	Distributor	2 nos.
80	Carburetor (two different types)	2 nos.
81	Watch pump and oil pump	2 nos.
82	Filling jig for adjusting piston ring gap	1 no.
83	Steel almirah 180 X 90 X 50 cm	1 no.
84	Black board 180 X 90 cm	1 no.
85	Desk or table 90 X 60 cm (for instructor)	1 no.
86	Valve key inserter	1 no.
87	Wall charts (driving instruction)	1 no.
88	Valve refresher	1 no.
89	Piston ring expander	1 no.
90	High rate discharge tester	1 no.
91	AVO meter	1 no.
92	Pneumatic tools	1 no.
93	Impact screw driver	1 set
94	General purpose puller	1 set
95	Stud extractor	1 set
96	Spring pliers	1 set
97	Torque wrench (set of three nos.)	1 set
98	Growler	1 no.
99	Battery charger	1 no.
100	Timing light	1 no.
101	Hydrometer	1 no.
102	Continuity meter	1 no.
103	Tyre changer	1 no.

C: GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name of the items	Quantity (indicative)
1	Grinder with two 7" wheels with twist drill grinding attachment	1 no.
2	Arbor press hand operator ½ ton	1 no.
3	Motor vehicle in running condition (diesel heavy)	1 no.
4	Light commercial vehicle – old 3 ton	1 no.
5	Heavy commercial vehicle	1 no.
6	Spark plug cleaning and testing equipment	1 no.
7	Air compressor – 2 stage – 500 liter with 5 HP motor and air receiver	1 no.
8	Mechanical hoist/plate form type	1 no.
9	Drilling machine (bench) 12mm dia	1 no.
	Arc Welding Machine Supply Voltage 390/415 V	1 no.

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

[kept optimum no. of tools and equipments with minimum specification which are essential for imparting basic training]

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: **CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR**

LIST OF TOOLS& EQUIPMENTS FOR 16 APPRENTICES

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

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	16+1 set
2.	Set square celluloid 45^0 (250 X 1.5 mm)	16+1 set
3.	Set square celluloid 30^0-60^0 (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	Quantity (indicative)
1	Models : Solid & cut section	as required
2	Drawing Table for trainees	as required
3	Stool for trainees	as required
4	Cupboard (big)	01
5	White Board (size: 8ft. x 4ft.)	01
6	Trainer's Table	01
7	Trainer's Chair	01

[Please do Not Change The Items In The Above Tool List.]

ANNEXURE – II

11. INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: CONSTRUCTION MACHINERY MECHANIC CUM OPERATOR

For Batch of 16 APPRENTICES

Actual training will depend on the existing facilities available in the establishment. However, the industry should ensure that the broad skills defined against On-Job– Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concerned industry may impart the training in cluster mode / in any other industry / at ITI.

ANNEXURE-III

12. GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

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

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

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

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

[Please do not make any change in this page]