

SYLLABUS FOR THE TRADE

OF

**MECHANIC (TRACTOR)
[Semester Pattern]**

**UNDER
CRAFTSMAN TRAINING SCHEME (CTS)**

Designed in– 2013

By
Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN-81, Sector-V, Salt Lake City
Kolkata-700 091

LIST OF TRADE COMMITTEE MEMBERS APPROVED THE SYLLABUS OF SEMESTER SYSTEM FOR THE TRADE OF “MECHANIC (TRACTOR)” HELD AT ATI, CHENNAI

Sl. No.	Name & Designation	Representing Organisation	Remarks
1	Shri R. Senthil Kumar, Director	ATI, Chennai	Chairman
2	Shri S.Harinath Babu, Joint Director of Training	ATI, Chennai	Member
3	Shri E.Balakrishna, Ex_Joint Director of Training	NIMI, Chennai	Member
4	Shri A.Suganthan, Assistant Training officer	Govt, ITI, Arakkonam	Member
5	Shri N. Ramesh Kumar, Training Officer	CTI, Chennai	Member
6	Shri T Nandagopal,	Anna University, Chennai	Member
7	Shri K. Thaniyarasau, Assistant Training officer	Govt . ITI, Trichy	Member
8	Shri P.K. Ramakrishnan Nair	Ram international Industrial Academy (p) Ltd, Chennai	Member
9	Shri S.Arul Selvan , Assistant professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
10	Shri S. Jayaraj, Associate Professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
11	Shri R. Lakshmanan	Bosch Ltd, Bangalore	Member
12	Shri V.ChandraMohan	NATRIP, Global Automotive Research centre, Chennai	Member
13	Shri V.Vadivelan	NATRIP, Global Automotive Research centre, Chennai	Member
14	Shri A.D.Shewale Training Officer	CTI, chennai	Member
15	Shri B. Gridharan	Visa Diesel Service, Chennai	Member
16	Shri K.k.Valasarajan , Vice president	Two Wheeler workshop owners Association, Chennai	Member
17	Shri Jayapal,	Two Wheeler workshop owners Association, Chennai	Member
18	Shri V. Vadivelan	Two Wheeler workshop owners Association, Chennai	Member
19	Shri Syedshwath	Two Wheeler workshop owners Association, Chennai	Member
20	P. Marveldass, Assistant Director of Training (Electronics)	ATI, Chennai	Member
21	K. ArulSelvi, Training Officer (Electronics)	ATI, Chennai	Member
22	Shri Gurcharan Singh, Assistant Director of Training	ATI, Ludhiana	Member
23	Shri O.R. Arjun Mohan, Assistant Executive Engineer	Agricultural Engg. Dept, Chennai	Member
24	Shri R.Murugesan, Assistant Executive Engineer	Agricultural Engg. Dept, Chennai	Member
25	Shri Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
26	C.Yuvaraj, Assistant Director of Training	ATI, Chennai	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member

17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1. Name of the Trade : **Mechanic (Tractor)**
2. N.C.O. Code No. :
3. Duration of Craftsmen Training : 1 Year(Two Semester)
4. Power Norms : 4.4 KW
5. Space Norms : 60 Sq. mtr.+ Parking area 188 Sq. mtr. separate

6. Entry Qualification : Passed in 8th Class Examination.
7. Unit strength : 16
8. Instructors Qualification : a) Degree in Automobile/Mechanical Engineering from recognized engg. college/university with one year experience in the relevant field
OR
Diploma in Automobile / Mechanical Engg. from recognized board of technical education with two years experience in the relevant field
OR
10th Passed + NTC/NAC in the Trade of “**Mechanic (Tractor)**” with 3 years post qualification experience in the relevant field
b) Preference will be given to a candidate with Crafts Instructor Certificate (CIC)

* **Note:** At least one Instructor must have Degree/Diploma in Mechanical/Automobile Engg. when applied for 02 units.

TRADE: "MECHANIC TRACTOR"

FIRST SEMESTER

Semester Code: MET;SEM-I

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Workshop Calculation & Science
1	<p>Introduction Training: Familiarisation with the Institute – importance of trade training. Introduction to machinery based in the trade-type of work.... The trainees in the institute – type of jobs done by the trainees in the trade, introduction to safety equipments and their use etc.</p>	<p>Importance of safety and general precautions observed in the section. Fire precautions for different types of fires – importance of the trade in the development of Industrial Economy of the Country – What is related instructions on the subject to be taught achievement to be made. Elementary First Aid. Recreational, Medical facilities and extra-curricular activities at the Institutes (All necessary guidance to be provided to the newcomers to become familiar with the Industrial Training Institutes System including stores, procedures etc.)</p>		
2	<p>Use of Fitter's hand Tools care and maintenance of tools, filing practice.</p>	<p>Safety precautions, description of Fitter's hand tools, chisels, hammers, hacksaw, files, drill, taps dies and surface plate etc. care and maintenance of tools.</p>	<p>Applied workshop problems involving multiplication and division, common, fractions, addition, subtraction, multiplication and division application of fractions to shop problems.</p>	<p>Free hand sketching of straight lines, rectangles, squares circles, polygons etc.</p>
3	<p>Filing – Filing to line making off – use of centre punch, dividers, calipers, steel, rule etc. Filing true and square.</p>	<p>Marking out, chipping and sawing hacksaw blades and its selection, causes of breakage of blades. Filing classification of files, different filing operations. Use of measuring instruments, vernier caliper etc.</p>	<p>Properties & use of case iron, wrought iron, plain carbon steel, high speed steel & alloy steel.</p>	<p>Free hand sketching with dimension and proportionate sketching.</p>

4	Chipping, grinding of chisels hacksawing.	Marking out for drilling, Ratchet brace – its manipulation and use. Hand drill brief description, operation and use. Flat and twist drills cutting angles and chisels.	Applied workshop problems as in week No. 2	Reading of simple blue print.
5.	Simple drilling, use of taps and dies. Use of hand reamers	Type of reamers – the manipulation and uses. Tapes and dies – their use.	Properties & uses of copper, zinc, lead, tin, aluminum, brass, bronze, solder, bearing metals, timber and rubber.	Reading of simple blue print.
6.	Introduction to centre lathe, setting up work between centers. Use of side cutting tools. Parallel turning and stepped turning.	Safety precautions in the use of lathe – essential parts, their description and functions.	Decimal – addition, subtraction, multiplication, conversion of decimals to common fractions – shop problems.	Free hand sketching with dimension of simple
7.	Joining of metals by soft soldering. Simple marking out of sheet metal. Joining of metals by gas and electric welding.	Sheet metal worker's common hand tools, their names and description. Safety precautions, simple forging process, simple heat treatment to cutting tools, Description of simple soldering and brazing fluxes used on common joints.	Brief description of manufacturing process of pig iron and cast iron.	Sketching of views of simple solid bodies as in week No. 6 above when viewed perpendicular to their surfaces and axis.
8	Simple sheet metal work cutting, bending & simple fold joints.	Sheet and wire-gauges. The blow lamp --- its uses and pipe fittings.	Reduction of common fraction to decimal fractions – shop problems.	Sketching of views of simple solid bodies as mentioned when viewed perpendicular to their surface and axis.
9.	Pipe bending and annealing, fitting of nipples & unions by soldering, brazing by using blow lamp.	Description giving composition manufacture of various common engineering materials like cast iron, mild steel. Brass, bronze, copper and aluminum.	Brief description of manufacturing process of steel, copper and aluminum.	Sketching of views of simple solid bodies as mentioned when viewed perpendicular to their surface and axis.
10	Measuring diameter of piston, main journals, crankpins. Big & main bearing, cylinder bore with	Description, proper handling of scale, feeler gauge. Calipers and precision	Units, Drive and fundamental, type of system FPS, CGS, MKS and	Views of simple hollow and solid bodies with dimensions of use

	ordinary caliper and micrometer and vernier caliper, telescopic gauge.	measuring instruments, micrometer (inside /outside) vernier caliper, telescopic gauge,	their conversion.	of different types of lines and symbols for drawing.
11	General cleaning, checking and tightening of nut & bolts, study of different types of nuts & bolts, locking devices of tractor, Such as lock nuts, cotter, split pins, keys, circlips lock rings lock washers and locating where they are used removal of broken stud/bold from blind hole.	Study types and uses of temporary and permanent fasteners used in Tractor Agriculture Machineries. Description of types of threads, head and screw points of screws, Nuts, Bolts & Studs and materials used types of nuts, locking devices key and splines, Description of chemical used as carbon remover antirusting & derusting solution.	Meaning of tenacity elasticity malleability, brittleness, hardness, compressibility & ductility and their examples.	Free hand sketching of rivets and washers with dimensions from samples.
12	Study and operation of General shop power tools & equipment such as pneumatic nut runner, riveting tools, Arbor press & hydraulic press.	General introduction and uses working safety of shop hand tools – type of screw drivers, spanners set., types of wrenches, plier punches and hammers, shop power tools & equipment function and maintenance, air compressor, Hoist Hydraulic/ mechanical jack, Jack stand, support, lift (cranes) Hydraulic press arbor press; cleaning equipment Car washer, cleaning tank, steam cleaner and Radiator flushing tank pneumatic tools for tightening and opening nuts & bolts.	Shop's problem on metric system of weight and measurement.	Free hand sketching of key and screw threads with dimensions from samples.
13	General servicing of Tractor, washing cleaning, oil greasing and lubricating all moving parts of tractor and Inspection of all the major components. Use of mechanical hydraulic jack car hoist, support wheel choke.	Development of mechanical framing, use of Bulldozer and tractor and various tractor assemblies and their function.	Effects of alloying elements on properties of cast iron & steel.	Free hand sketching of key and screw threads with dimensions from samples.

14	Checking engine auxiliaries, fuel, oil & cooling system. Practice in starting, running and stopping engine.	Description of various types of tractors in general use their advantages and disadvantages, chassis frame of a tractor – constructional details of a tractor. Reinforcement of engine mountings on chassis. Precautions observed while starting, running and stopping the tractor.	Effects of alloying elements on properties of cast iron steel.	Free hand sketching of key and screw threads with dimensions from samples.
15	Study of different major components of tractor and their function & placement study of different make tractor in Institute with different dealers or organizations.	Study of different major components & assemblies of tractor, and different make (indigenous). Tractor – Name place – constructional differences and their merits.	Metric system weight and measurement units conversion factors.	Free hand sketching of nuts & bolts with dimensions from samples. Free hand sketching of different major assemblies of tractors.
16	Removal of wheels from tractor, dismantling tyre & tubes – checking puncture in tube and repairing puncture by hot/ cold patches and vulcanizing method, assembly – according to field & road	Description of different types of tractor wheel assemblies. Function & types wheel tyres solid pneumatic & tubeless tyres, constructional details, size description ply rating, trade design and their uses, types of rim.	Shop's problems on metric system of weight and measurements.	Free hand sketching of nuts & bolts with dimensions from samples. Free hand sketching of different major assemblies of tractors.
17	Dismantling tyre to checking different rims, repairing, derusting, painting, re-assembling after changing direction of tyre, for tyre rotation practice.	Wheel tyres and tubes – solid and pneumatic tyre – various types and sizes description and use. Fitting of tyres and tubes. Importance of inflating tyres to correct pressure. Repair & maintenance of tyre & tubes. Balancing of tractor wheels. Storage of tyres.	Ratio and proportion shop problems. Percentage & its application.	Views of simple hollow and solid bodies with dimensions. Use of different type of lines and symbols for drawing. Free hand sketching of tyres showing under over the proper inflation of tyres.
18	Fitting wheels on tractors – tightening wheel holding nuts in correct sequence. Measuring & setting different wheel track of front & rear wheel. Wheel base & ground height of different tractors.	Importance of wheel track, wheel base, ground height, description of steering geometry, chamber, castor, toe-in-toe-out on turning and effects of these angles.	Fits, limits, tolerance and allowances. Square root, perfect square. The square of a whole number and a decimal.	Explanation of simple orthographic projection – 1 st . Sketch showing direction of tyre rotation of tractor.

19	Overhauling steering assembly including inspection, repair / replacement of parts from axles. Steering assembly and testing for correct function	Steering – description construction & function of steering gear unit including wheel, rod, worm quadrant arm link, tie rod, ball and socket joints etc. their movement and adjustment. Description and mechanism of foot steering pedals as incorporated in tractors.	Mass – unit of mass, force absolute unit of force. The weight of a body – unit of weight shop problem.	Explanation of simple orthographic projection 3 rd engine. Free hand sketching showing steering system in Tractor.
20	Study the working of power tiller in field starting operating clutch and steering system. Overhauling steering system & brakes of power tiller including dismantling, cleaning, checking & refitting, testing for correct functioning.	Description & working principle of the steering system. In power tiller (two wheel tractor) steering by brake. Steering clutch & its description.	C.G>S> & F>P>S> system of units of force, weight etc. their conversion problems.	Views of simple hollow and solid bodies with dimensions. Use of lines and symbols for drawing.
21	Overhauling breaks including cleaning and inspection of all components, relining shoes, setting and actuating shoe clearance angle inspecting spring of both shoe & lever Inspecting and setting hydraulic main brake including replacement of washer & Oil Seal. Overhauling serve mechanism (as applicable) inspecting piston & valves, bleeding and adjustment of brakes. Fault tracing & remedy.	Brakes types used or tractors, mechanical hand brake for sparking its fitting and adjustment. Description working principle and function of hydraulic brakes function of master & auxiliary cylinder. Bleeding & adjustment of brake, shoes & drums their fitting knowledge of disc type brakes.	Work unit of work energy power units of power applied problems.	Views of simple hollow & solid bodies with dimensions. Use of different types of lines and symbols of drawing, Free hand sketching of braking system of tractors (Mechanical brakes system).
22	Overhauling brakes including cleaning and inspection of all components, Relining shoes, setting and actuating shoe and lever, Inspecting & setting hydraulic main brake including replacement of washer and oil seals. Overhauling serve mechanism (as applicable) inspecting piston and valves, bleeding and adjustment of brakes, Fault tracing and remedy. Skimming of brake drum	Brakes – type used on tractor mechanical hand brake for parking, its fitting & adjustment. Description. Working principals & function of hydraulic brakes, function of master & auxiliary cylinder, bleeding and adjustment of brake serve system, lay-out and work principle – brake, shoes and drums, their fitting, knowledge, of disc type	Simple Problems on work, energy & power.	Simple isometric drawing, isometric views of simple objects such as square, rectangles, cubes, rectangular block etc. Free hand sketch of working Hydraulic brakes system showing detail description Master cylinder and wheel cylinders.

	and disc plate.	brakes.		
23	Dismantling of unserviceable engine cleaning studying the parts of the engine and reassembling the engine, practice in use of correct tools & right procedure.	Description of internal & external combustion engines different types of I.C. engines. Important working parts in the engine, the 4 stoke cycle of operation, single cylinder & multi cylinder engines. Types of engines fitted on tractors, various methods of starting of engine.	Meaning of friction of examples, meaning of centre of gravity – examples specific gravity examples.	Simple isometric drawing isometric views of simple objects such as square, rectangles, cubes, rectangular block etc. Free hand sketching of 4 stoke cycles & 2 stoke cycles of engine.
24	Cylinder head overhaul pressure testing, phasing decarbonising engines, facing valves & valves of seats and grinding valves on seat, fitting valves guides, fitting springs, caps, Cotters & fitting of valve seats, inserts. Use of torques wrench, correct sequence of tightening cylinder head bolts.	Description and function of engine assemblies such as cylinder block, crank case, crank shaft – connecting rod, pistons, camshaft tappet and valves.	Simple problems straight and bell-cranked levers.	Use of drawing instruments, T-square & drawing board, Free hand sketching of crank shaft showing all parts.
25	i) Project Work ii) Industrial visit (optional)			
26	Examination			

Competence :

1. To use measuring tools and instruments – calipers, compass, try square, feeler gauge – dial test indicator, vernier micrometer, pressure gauges, vacuum gauge Techometer.
2. To Handling machines and their accessories, such as simple drilling machine pedestal grinding power press, Lathe air compress Car Hoist and Car Washer, Pneumatic Nut runner & reveting machine.
3. To perform operation or tractor, clutch assembly, gear box, differential steering brakes etc.
4. To understand and solving calculations, problems related to the trade.
5. To know read, and understand : Simple blue print, read and making of free hand sketching.

TRADE: "MECHANIC TRACTOR"**SECOND SEMESTER****Semester Code: MET;SEM-II**

1	Removing pistons and connecting rods from engine, dismantling, cleaning, inspecting, checking clearances, installing rings and piston pins.	Description & function of different types of pistons, pistons pins – common troubles and remedy.	Calculation of volume and weight of simple solid bodies such as cubes, square and hexagonal prism – shop problem.	Construction of simple figures and solids as mentioned above with dimensions & titles. Use of different types of scales in inches and millimeters.
2	Removing connecting rod assembly connecting rod alignment cleaning checking bearing clearances, replacing bearing shells, setting correct clearances. Measuring Wear in crank pins and main journals in crank shaft.	Description & function of connecting rod. Materials used for connecting rods big end & main bearing. Shells piston pins and locking methods of piston pins. Crank shaft description, functions & type common troubles & remedy.	Heat and temperature thermometric scale Fahrenheit and centigrade scales & their conversion. Name & use of temperature measuring instruments normally used in Workshop.	Construction of simple figure and solids as mentioned in week No. 26 with dimensions & titles. Use of different types of scales in inches and millimeters.
3	Assembling crank shaft, main bearing, connecting rods and piston assembly in the engine, fitting cylinder head. Setting valve timing. Reassembling and starting the engine. Tuning up engine for smooth slow speed running.	Firing order of the engine & crank-shaft balancing description of the fly wheel & its function. Crank case & oil pump. Valve timing diagram gears timing mark, chain sprockets chain tensioner etc.	Head and temperature thermometric scale Fahrenheit & Centigrade scales & their conversion. Name and use of temperature measuring instruments normally used in workshop	Construction of simple figure & solid as mentioned in week No. 24 with dimensions & titles. Use of different types of scales in inches & millimeters. Sketching valve timing diagram.
4	Checking cooling system for overheating, cleaning, radiators, dismantling, cleaning, assembling & testing water pumps, reverse flushing the system & adjusting the fan belt tension.	Engine cooling methods air & water cooling radiators, pump, thermostats and fan their description, function care & maintenance. Reasons for engine overhauling.	Heat & temperature thermometric scale, Fahrenheit and Centigrade scales & their conversion name & use of temperature measuring instruments normally used in workshop.	Lettering number and alphabet. Free hand sketching of different cooling system showing all necessary parts.
5	Studying the lubrication oil	Need for lubrication of	Shop problems on	Lettering number

	flow in engine overhauling oil filters, oil pump and setting the pressure release valve for correct oil pressure maintenance & repairs in the lubrication system in engine.	engine parts friction, lubrication oil & its properties lubrication system types – full flow and bypass flow system oil filters and pumps types their special features and uses	determination of volume and weight of simple bodies.	& alphabets. Free hand sketching of lubrication system, filters and different types of oil pump, pressure release valve.
6	Tracing of different parts of fuel system. Bleeding fuel lines for Air locks repairing fuel leaks in pipe line and unions cleaning of oil and air filters in diesel engines.	Fuel system – types & grades of fuel used – properties of fuel. Fuel used in diesel engines specification of diesel fuels importance of cleaning fuel generally – out of the fuel feed system in the stationary and tractor diesel engine. Combustion chambers types advantages & disadvantages heater plugs type uses.	Geometry properties of lines, angles, triangles & circles.	Free hand isometric sketching of simple objects with dimensions. Free hand sketching of fuel feed system in diesel engines and fuel feed system in diesel engines and fuel filters.
7	Simple repairs in fuel feed system. Servicing of fuel filter & air cleaners.	Fuel feed system used in Tractor's description and lay out of the systems. Description, operation, maintenance of fuel pump, feed pumps, fuel filters and air cleaners.	Factor of safety examples, different types of stresses examples.	Free hand sketching isometric of simple dimensions. Free hand sketching of different types of injectors.
8	Cleaning and servicing of primary fuel filter and pressure stage filters removing feed pumps dismantling, cleaning, reassembling, refitting and testing the feed pump.	Type of fuel injection pump systems – air injection & airless injection fuel feed pumps description, operations, common troubles and remedy.	Effect of forces on material in such application as extending, bending & shearing.	Free hand sketching of plain and elevation of simple objects like hexagonal bar, square bar, circular bar, tapered bar, hollow bar etc. Free hand sketching of single element plunger of fuel injection. Pump.
9	Removing F.I. Pumps from running engine. Changing oil, fitting back to engine, testing the governor & setting injection taming.	Fuel injection pumps description & operation types, adjustment in the pumps phasing and calibration of pump checking and fixing injection timing governors – types their description & operation, starting and	Technical advantage, velocity ratio and applied problems.	Free hand sketching of plain elevation of simple objects like hexagonal bar, square bar, circular, tapered bar, hollow bar etc. Free hand sketching of air

		adjustment of slow speed. Reason for black, white & blue smoke in exhaust.		cleaner used in tractors.
10	Testing injectors for missing on the Tractor removing, dismantling, cleaning, inspecting, replacing defective parts reassembling the injectors and testing them & setting injection timing in engines (both stationary and Tractor engine)	Injector nozzles types, description, operation, testing of injectors, special features of pintle nozzles. Timing of injection in single cylinder engine flange type pumps and their special features, care & maintenance of single cylinder pumps.	Useful work of machine – mechanical efficiency of machine problems.	Views of simple solid and hollow bodies cut by section plane.
11	Practice adjusting clutch pedal play, removing gear box and clutch assembly from tractor, Dismantling cleaning, inspecting repairing clutch plates and pressure plate	Layout of transmission system, description of frictional clutches, single and multi plates clutches, clutch linings Material, fluid coupling description and different adjustments troubles and remedies	Machines – basic principles, determination of velocity ration, mechanical advantage and efficiency.	Reading of simple blue print. Free hand sketching of clutch assembly.
12	Overhauling gear Box, Transfer case, auxiliary gear box.	Purpose of gear box in tractor types of gear boxes. Constant sliding Mech. Principle of epicyclic gear box. Auxiliary transmission. Low & lugs gear ration, universal joint and propeller shaft.	Machines basic principle, determination of velocity ratio, mechanical advantage and efficiency.	Exercise on blue print reading. Free hand sketching showing different gear arrangement in gear box.
13	Overhauling differential reduction gear, rear axle wheel hub & differential lock.	Differential carries double reduction gearing, differential lock, Front wheel drive, crown wheel and pinion adjustments, adjustments, power take off mechanism. Types front & rear axles common trouble and their remedies care and maintenance.	Logarithm – use of logarithmic tables for multiplication and division.	Exercises on blue print reading. Free hand sketching of differential and reduction gearing system in rear axle.
14	Study the layout & operation of hydraulic system in tractor overhauling hydraulic system, pumps, control valves and remote cylinders.	Use of hydraulic system in tractor, types of pumps, control valves, safety valves, strainer & remote cylinders. Three point linkages, operating levers, study of different circuits. Description of depth /	Determination of efficiency of simple machines like winch, pulley locks, wheel and compound axles.	Exercises on blue print reading. Layout of hydraulic system in tractor for lift system.

		draft position. Operation of remote control in Hydraulic system, self sealing material used in system, description of pressure hose pipe Fault finding & remedies in Hydraulic systems.		
15	Overhauling power tiller transmission system including main clutches, steering clutch / brakes mechanism – gear box and wheel & hub testing for field operation without implements and with implements. Driving practice with trolley / traylor.	Description, working principle & use of power tiller (two wheel tractor) power unit. Method of power transmission to wheel from engine. Main clutch assembling working procedure steering. Clutch / brakes mechanism method of power transmission to implement (Rotation), irrigation pump, thresher. Hitching of M.B. Plough, trailer disc harrow.	Further practice in the use of logarithm tables.	Exercise on blue print reading.
16	Servicing storage batteries electrical and starter system.	Electrical equipments lighting arrangement in tractors (as applicable) including storage battery, dynamo, regulator switch & spot lights both front & rear, Maintenance of battery.	Electricity and its use. Electric current, positive terminals. Use of switches and fuse - -- conductors & insulators.	Free hand sketching of simple objects related to the trade & preparation of simple working drawing & sketches. Free hand sketches of lighting system in tractor.
17	Servicing storage batteries electrical and starter systems.	Electrical equipments lighting arrangement in tractors (as applicable) including storage battery, dynamo, regulator switch & spot lights both front & rear, Maintenance of battery	Ohm's Law. Measuring current voltages – resistance in circuit.	Free hand sketching of simple objects related to the trade & preparation of simple working drawing and sketches.
18	Tracing lighting circuit and fault rectification.	Description of lighting circuit, setting of regulator for correct charging rate, fault finding, in electrical system.	Different from of energy, neat mechanical and electrical examples, conversion from one to another.	Further practice in blue print. Reading & exercises related to the trade.
19	Checking tractor	Tractor equipment –	Generation of	Further practice in

	implements such as disc harrow, grass cutter, lawn mower, ploughs, cultivators, P.T.O. Units etc. for serviceability before use and lubricating them as required. Fitting them to tractors and adjusting them for correct functioning.	description & function of offset and tandem disc harrow seed drill ploughs of different types etc. Fitting and fixing of equipment. Danger in overloading & incorrect hitching of ploughs, Average life of plough, shares and disc.	electricity AC & DC generators & motors charging circuit in a vehicle.	Blue Print Reading & exercises related to the trade.
20	Checking tractors implements such as disc harrow, grass cutter, lawn mower ploughs, cultivators, PTO Units etc. for serviceability before use and lubricating them as required. Fitting them to tractors and adjusting them for correct functioning.	Tractor equipment – description & function of off-set and tandem disc harrow seed drill ploughs of different types etc. Fitting & fixing of equipment. Danger in overloading and incorrect hitching of ploughs. Average life of plough, shares & disc.	Plotting & reading of simple graphs.	Further practice in blue print. Reading and exercises related to the trade.
21	Visit to tractor Service Stations & observing use of servicing equipments. Study of Job cards. Process sheets. Studying Work shop system and layout. Importance of log books.	Short description of various equipments used by service station.	Meaning of Horse Power and Brake Horse Power. Simple problem on work energy & power rating.	Free hand sketching of simple objects related to the trade & preparation of simple objection working drawing from sketches.
22	Exercise in driving a Tractor with different implements. Use of various types of meters dash boards instruments etc.	Description & function of tractor implements & accessories, drawbar to correct height use of hydraulic lift & belt pulley mounted on tractors. Maintenance of tractors. Maintenance of tractor accessories, Driving, Servicing & maintenance of tractor. Motor Vehicle Act. Driving Rules.	Calculation of volume and weight of simple solid bodies by using logarithm.	Further practice in Blue Print Reading & Exercises related to the trade.
23	Visit to Nearest Quality control Centre / Institution and factories to see their Quality control Systems and consult commercial Technical specifications. Services of experts from the related university / institution / Test agencies involved in Teaching /	All the standard available with Bureau of Indian Standard Institution and Quality Control Institution related to Quality Control and Commercial Technical Specifications to manufacture, fabricate		

	Testing of farm Machinery should be invited to cover the syllabus and Quality Control and commercial Technical specifications.	and safety, Visual, mechanical Inspection of product during and after final assembly, functional Test of Sub assemblies and finished product Test operations Maintenance / Calibration of Inspection of Test Equipments.		
24	Trouble shooting in Tractor Driving & testing of the performance of the tractor & tractor driving with implement.			
25	Revision			
26	Examination			

TRADE – MECHANIC (TRACTOR)**List of Tools & Equipments****A. TRAINEES TOOL KIT FOR 16 TRAINEES +1 INSTRUCTOR**

SL. NO.	Items	Qty.
1.	Hammer ball peen 0.75 kg.	17 nos.
2.	Chisel cold flat 20 mm x 150 mm	17 nos.
3.	Centre Punch 100 mm	17 nos.
4.	Caliper outside spring 150 mm	17 nos.
5.	Caliper inside spring 150 mm	17 nos.
6.	Steel rule 15 cm English & Metric	17 nos.
7.	Screw Driver 750 mm x 6 mm	17 nos.
8.	Screw Driver 100 mm x 8 mm	17 nos.
9.	Spanner D. E. set of 6.7 mm to 15x16 mm	17 nos.
10.	Plier combination 150 mm	17 nos.
11.	Hand file second cut 250mm	17 nos.

B. GENERAL MACHINERY SHOP OUT FIT

Sl. No.	Items	Qty.
1.	2	3
1.	Rule steel 300 mm to read inches & mm	4 nos.
2.	Dividers spring 150 mm	4 nos.
3.	Prick punch 150 mm	4 nos.
4.	Chisel cross cut 9x3 mm	4 nos.
5.	Chisel diamond point 9 mm	4 nos.
6.	Chisel half round 9mm	4 nos.
7.	Hammer ball peen 0.5 kg.	4 nos.
8.	Hammer ball peen 0.25 kg.	4 nos.
9.	Hammer copper 1 kg. with handle	4 nos.
10.	Hammer plastic 0.25 kg. with handle	4 nos.
11.	Surface plate 60x60 mm	1 no.
12.	Hacksaw frame adjustable for 20 x30 mm blades	4 nos.
13.	'V' block pair with clamps 7.5 x 3.75 cm	2 nos.
14.	Punch hollow 6.7 x 9 mm set	2 sets
15.	Punch letters set 3 mm	1 set
16.	Punch number set 3 mm	1 set
17.	Hand Vice up to 375 mm	2 nos.
18.	Screw drivers of different sizes : (8x250 mm / 10x300 mm / 10x300 mm)	4 sets one each size
19.	Phillips Screw Driver kit blades 5 mm dia	2 kits
20.	File flat 350 mm bastard	4 nos.
21.	File flat 250 mm second cut	4 nos.
22.	File flat sage edge 250 mm smooth	4 nos.
23.	File triangular 150 mm second cut	4 nos.
24.	File half round 400 mm second cut	4 nos.
25.	File flat 200 mm smooth	4 nos.
26.	File square 300 mm rough	4 nos.
27.	File square 200 mm second cut	4 nos.
28.	Drill twist S.S. 1/8" to 1/2" x 1/64" set	2 sets
29.	Drill twist metric 3 mm to 12 mm x 1 mm	2 sets
30.	Taps and dies complete set in box B. A., B.S.W., B.S.F. American and metric	1 set each

31.	Rasp Cut file – 250 mm	1 no.
32.	H. S. S. Hand reamers, parallel 8 to 12 by 1.5 mm	2 sets
33.	H.S.S. hand reamer adjustable 111 to 12, 12 to 13, 13 to 15, 15 to 16 mm	1 set each
34.	H.S.S. hand reamer 3.5 to 12.5 mm in steps of 1.5 mm set of 12	1 set
35.	Scraper, bearing	4 nos.
36.	Chaser hard W/V 9 to 40 T.P.I. set of 11 external	1 set
37.	Chaser hard W/V 9 to 40 T.P.I. set of 11 internal	1 set
38.	Set of morse socket 0 – 1, 1 – 2, 2 & 3	2 sets
39.	Dial indicator to read 0.2 mm	2 nos.
40.	Screw pitch gauge with 22 pitches from 9 to 40 TPL	2 nos.
41.	Micro-meter, outside 0” – 1”	2 nos.
42.	Micrometer outside 0 to 25, 25 mm to 50 mm	2 nos.
43.	Micrometer outside 50 mm to 75 mm, 75 mm to 100 mm, 100 mm to 125 mm, 125 mm to 150 mm	1 each
44.	Micrometer inside 25 to 50 mm with extension rod. 50 to 75 mm with extension rod.	2 each
45.	Vernier caliper set 150 or 200 mm inside and outside, depth to read inches and mm	1 no.
46.	Safety goggles (Clear Glass)	2 Pairs
47.	Hammer, Planishing	2 nos.
48.	Setting hammer	2 nos.
49.	Mallet (wooden)	2 nos.
50.	Trammel 300 mm	1 no.
51.	Blow lamp	2 nos.
52.	Soldering iron 120 watt.	2 nos.
53.	Soldering iron copper 280 gms. (Fire heated)	2 nos.
54.	Snip Straight, 250 mm	2 nos.
55.	Stake, hatchet type	2 nos.
56.	Stake grooving	2 nos.
57.	Grover – 3,4,6 mm	1 each
58.	Round long nose plier 150 mm	2 nos.
59.	Round flat nose plier 150 mm	2 nos.
60.	Pot Melting	2 nos.
61.	Shovel	1 no.
62.	Rake	1 no.
63.	Poker	1 no.
64.	Spanner double open ended set of 12 pcs. Sizes 6 x 7 to 27 x 32 metric set	4 sets
65.	Spanner double open ended set 12 pcs. SAE ¼ x 5/16” to 1 1/8” x 1 1/4”	2 sets
66.	Spanner double open ended set of 12 pcs. Size WW English 1/16’ x 3/32’ to ¾’ x 7/8’	2 sets
67.	Spanner double open ended jaw long pattern Spanner 6 x 7 to 27 x 32 mm	2 sets
68.	Water pump plier	2 nos.
69.	Pipe Wrenches 250 mm, 350 mm, 450 mm	2 each
70.	Spanner adjustable 150 mm, 200 mm	2 each
71.	Spanner bi-hexagon Impact socket set 20 pcs. Size 12.5 mm (½”) 11 mm to 32 mm with Speed handle, offset handle (siding bar) Angle handle, extension and universal Joints & ratchet handle.	2 sets
72.	Spanner bihexagon Impact socket set 20 pcs. Size 12.5 mm (½”) SAE 3/8” to 1 1/4” with speed handle, offset handle (siding bar)	2 sets

	handle) angle handle, extension and universal joint and ratchet handles	
73.	Double open ended tappet spanner from 11 x 13 mm to 16 x 17 mm	1 set
74.	Drift copper 150 mm of different dia	2 each
75.	Gun paraffin set	1 no.
76.	Gun, grease pressure	1 no.
77.	Chain & Block 3000 kg. (3 ton)	1 no.
78.	Tray cleaning assorted sizes	8 Nos.
79.	Valve seat lapping tool suction type	6 nos.
80.	Valve seat lapping tools screwing type	1 no.
81.	Valve seat cutting, tools complete with Guides and pilot bar (all angel(and sizes	1 no.
82.	Valve refacing Machine	1 no.
83.	Stud extractor (suitable to drive all sizes of studs)	1 no.
84.	Stud remover (soutable to remove all sizes of broken studs or bolts)	1 set
85.	Compression gauge to read 0 to 250 kg/sq. cm	1 no.
86.	Vacuum gauge 0 to 75 cm	1 no.
87.	Fuller set for steering wheel universal	1 set
88.	Fuller set universal for bearing and bushes	1 set
89.	Connecting rod alignment fixture	1 set
90.	Pneumatic Tools for tightening and opening Nut & Bolts	
91.	Pneumatic reveting tools.	
92.	Stone Carborandum 15x5x4 cm Smooth and rough	1 each
93.	Injector Testing machine (Hand tester)	1 no.
94.	Cylinder Gauge capacity 6 to 15 cm	1 no.
95.	Ring expander and remover	1 no.
96.	Torque Wrench (0 to 150 Lbs. – ft.)	1 no.
97.	Ring groove cleaner.	1 no.
98.	Ring Compressor	2
99.	Torque Wrench (0to 10 kg. meter)	1 no.
100.	Work bench 255 x 120 x 60 cm with 4 vices 12.5 cm jaw.	1 no.
101.	Lockers with 8 drawers (standard size)	4 nos.
102.	Starter motor.	2 nos.
103.	Hydraulic Pump, control valves (two types)	2 nos.
104.	Injectors (four types)	2 each
105.	Water pump & Oil Pump of different types	3 each
106.	Feeler gauge for checking tappet clearance	2 Nos.
107.	Feeler gauge for checking piston clearance	2 Nos.
108.	Injector cleaning kit	2 nos.
109.	Filing jig for adjusting the piston ring gap	1 no.
110.	Steel Almirah	4 nos.
111.	Instructor table	1 no.
112.	Chair arm and with arm	3 Nos.
113.	Fire extinguisher	2 nos.
114.	Fire buckets with stand	4 nos.
115.	Class furniture Dual desk with stool or benches 20 Nos.	20 Nos.
116.	Techometer (counting type)	1 no.
117.	Brake drum spring balance belt etc. for performance testing of engine	1 set
118.	Lifting jack screw type 3000 kgs.	4 nos.
119.	Equipment puncture, in box	1 no.
120.	Spray Gun with accessories	1 no.

C. GENERAL EQUIPMENT

1.	Grinder with two 18 cm wheels with twist drill grinding attachment.	1 no.
2.	Compressor capacity 12 c. ft. piston type with pressure gauge (for inflating of tubes) spray gun etc.	1 no.
3.	Hydraulic Jack HI-LIFT type (Trolley type)	2 Nos.
4.	Car (Tractor) washer reciprocating type double piston electric operated with water	1 no.
5.	Wheel type tractor fitted with diesel engine with standard accessories and special tools (25-35-45) draw bar HP of different make.	3 nos.
6.	Rotavator	1 no.
7.	9 tine cultivator-spring loaded mounted type	1 no.
8.	3 furrow disc plough with scrapers	1 no.
9.	Ridger	1 no.
10.	P.T.O. operated rotary lawn mower	1 no.
11.	Rare axle assembly gear box steering box assembly of Diesel engine tractor.	2 set each
12.	Desktop computer latest configuration and related MS office software	1 no.
13.	Laser printer	1 no.

Note: (1) No additional items are required to be provided for the batch / unit working in second shift except the its indicated under the trainees kit lockers for trainees.

(2) The specification of the items sin the above list have been given in metric units. The items which are available in the market nearest to the specifications as mentioned above, if not available as prescribed should be procured. Measuring instruments such as steel rule which are graduated both in English and Metric units may be procured, if available.

D. WORKSHOP FURNITURE

Sl. No.	Description	Quantity
1	Discussion Table	1 no.
2	Tool Cabinet	2 nos.
3	Trainees locker	Required to accommodate 16 lockers
4	Book shelf (glass panel)	1 no.
5	Storage Rack	2 nos.
6	Storage shelf	2 nos.
7	Computer table	1 no.
8	Computer chair	2 nos.
9	Printer table	1 no.
10	Online UPS 2KVA	1 no.