

MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI

1	Name of Course	Certificate Course in Tractor Mechanic				
2	Max no. of Students	25		Course Code - 306206		
3	Duration	1 year				
4	Course Type	Full Time				
5	No. of Days per week	6 days				
6	No. of hours per day	7 Hrs				
7	Space require	Theory Class Room – 200 sqft Practical Lab – 1000 sqft Total – 1200 Sqft				
8	Entry qualification	S.S.C. Pass				
9	Objective of syllabus	To understand basic of Tractor engine, To do maintenance of Tractor engine				
10	Employment opportunities	work as Mechanic in Tractor garages, tractor workshop, service station, can start own tractor mechanic workshop				
11	Teachers Qualification	Diploma in Mechanical engg, Diploma in Automobile engg. or Equivalent and 2 yr Experience.				
12] Teaching Scheme – Training System Per Week						
		Theory	Practical	Total		
		18 Hrs	24 Hrs	42 Hrs		
13] Examination Scheme –						
Sr	Paper Code	Name of Subject	Theory/ Practical	Hours	Max Marks	Min Marks
1	30620611	Tractor Mechanic	Theory - I	3 Hrs	100	35
2	30620612	Tractor Servicing	Theory – II	3 Hrs	100	35
3	30620613	Workshop Calculation, Science and Drawing	Theory – III	3 Hrs	100	35
4	30620621	Tractor Mechanic	Practical – I	3 Hrs	100	50
5	30620622	Tractor Servicing	Practical – II	3 Hrs	100	50
6	30620623	Workshop Calculation, Science and Drawing	Practical - III	3 Hrs	100	50
				Total	600	255

Tractor Mechanic

	Practical – I Tractor Mechanic	Theory - I Tractor Mechanic
1.	2.	3.
1.	INDUCTION TRAINING : Familiarisation with the Institute- importance of trade training. Introduction to machinery used in the trade –type of work done by trainees in the Institute type of jobs done by the trainees in the trade introduction to safety equipment's and their uses etc.	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 the Industrial Economy of the Country –What is related instructions on the subject to be tough achievement to be made. Elementary First Aid. Recreational , Medical facilities and extra –curricular activities at the Institutes (All necessary guidance to be provide to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures etc.
2	Use of Fitter's hand tools care and maintenance of tools , filing practice.	Safety precautions , description of Fitter's hand tools , chisels. Hammers, hacksaw, files, drill, taps, dies and surface plate etc. Care and maintenance of tools. Workshop Calculation & science : Applied workshop problems involving multiplication and division, common fractions addition , subtraction, multiplication and division application of fraction of shop problems. Engg. Drawing : Free hand sketching of straight lines , rectangles , squares , circles polygons etc.
3.	Filing –Filing to line marking off –use of center punch, dividers , calipers, steel rule etc. Filing true and square.	Marking out, chipping and sawing hacksaw blades and its selections , causes of breakage of blades . Filing classification of files. Different filing operations. Use of measuring instruments., vernier caliper etc. Workshop Calculations & Science : Properties and uses of cast iron , wrought iron. Plain carbon steel, high speed steel & alloy steel. Egg. Drawing : Free hand sketching with dimension and proportionate sketching.
4.	Chipping , grinding of chisels hacksawing.	Marking out for drilling Ratchet brace –its manipulation and use . Hand drill brief description, operation & use . Flat and twist drills cutting angles of chisels. Workshop Calculation & Science : Applied workshop problems as in week No.2. Egg. Drawing : Reading of simple Blue print.
5.	Simple drilling . Use of taps and dies. Use of hand reamers.	Type of reamers the manipulation and uses. Taps & dies their uses. Workshop Calculation & Science : Properties and uses of copper zinc , lead , tin aluminum., brass, bronze, solder, bearing metals, timber and rubber Engg. Drawing : 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. Workshop Calculation and Science: Deciamal-adddition, subtraction multiplication, conversion of decimals to common fractions-shop problems. Engg. Drawing: Free hand sketching with dimension of simple solid such as cubes, rectangular;, blocks, cylinders etc.
7.	Joining of metals by soft soldering. Simple marking out 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. Workshop Calculation & Science : Brief description of manufacturing process of pig iron and cast iron. Engg. Drawing : Sketching of views of simple solid bodies as 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 pie fitting s Workshop Calculation & Science : Reduction of common fractions to decimal fractions – shop problems . Engg. Drawing : Sketching of views of simple solid bodies as mentioned when viewed perpendicular to their surfaces and axis.
9.	Pipe Bending and appealing, 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 & aluminum. Workshop Calculation & Science : Brief description of manufacturing process of steel, copper and aluminum. Engg. Drawing : Sketching of views of simple solid bodies as mentioned above when viewed perpendicular to their surfaces and axis.
10.	General cleaning, oiling and greasing of tractors. Checking and tightening of bolts and nuts. Function of different parts of the tractor.	Development of mechanical framing . Use of bulldozers and tractors , various tractor assemblies and their functions. Workshop Calculation & Science : Metric system weight and measurements units conversion factors. Engg. Drawing : Free hand sketching of nuts & bolts with dimensions from samples.

11.	Checking engines auxiliaries, fuel , oil and cooling system . practice in starting , running and stopping engine.	Description of various types of tractors in general use their advantages and disadvantages . chasis frame of a tractor constructional details . Reinforcement of engine mounting on chasis. Precautions observed while starting, running and stopping the tractors. Workshop Cal. & Science : Meaning of tenacity elasticity, malleability, brittleness, hardness, compressibility & ductility and their examples. Engg. Drawing : Free hand sketching of rivets and washers with dimension from samples.
12.	Removing wheels from tractors; checking tyres for wear and tubes for leaks. Repairing puncture.	Wheel tyre and tubes solid and pneumatic tyres. Various and size, description and use fitting of tyres & tubes importance of inflating tyres to correct pressure. Repair and maintenance of tyres and tubes. Workshop Cal. & Science : Shop's problems on metric system of weight and measurement. Engg. Drawing : Free hand sketching of key and screw threads with dimension from samples.
13	Practice on refitting tyres and tubes and wheels and inflating the correct pressure.	Wheel tyres and tubes solid and pneumatic tyres various types and sizes description and use. Fitting of tyres and types inflating tyre to correct pressure. Repair and maintenance of tractor wheels . Workshop Cal. & Science : Effects of alloying elements on properties of cast iron & steel . Engg. Drawing ; Free hand sketching of key and screw threads with dimension from samples .
14.	Fitting wheels on tractors tightening wheel holding nuts in correct sequence wheel track setting front and rear .	Fits , limit tolerance and allowances. Workshop Cal & Science : Square root perfect square. The square of a whole number and a decimal. Engg. Drawing : Explanation of simple orthographic projection-Ist.
15.	Overhauling steering assembly including inspection, repair /replacement of parts front axles, spindles. Reassembling steering assembling and testing for correct functioning.	Steering description, construction 7 function of steering gear unit including wheel, rod, ball and socket joints etc. Their movement and adjustment description and mechanism of foot steerage pedals as incorporated in tractors. Workshop Cal. & Science : Mass unit of mass force absolute unit of force. The weight of a body unit of weight shop problem. Engg. Drawing : Explanation of simple orthographic projection 3 rd angle.

16.	Overhauling steering assembly including inspection repair / replacement of parts front axles, spindles. Spindle Reassembling steering assembly and testing for correct functioning.	Steering description. Construction and function of steering gear unit including wheel rod worm quadrant arm link tie rod, bell and socket joints etc. Their movement and adjustment, description and mechanism foot steering pedals as incorporated in tractors. Workshop Cal & Science : Percentage and its application shop problems. Engg. Drawing : Views of simple hollow and solid bodies with dimension. Use of different types of lines and symbols for drawing.
17.	Dismantling brake system pedal mechanism. Cleaning, inspecting and repairing parts as necessary and reassemble. Testing for correct functioning.	Description and working principle of the steering system on crawler type tractors. Steering by brake steering –clutch its description, function, adjustment and maintenance. Workshop Cal. & Science : C.G.S.& F.P.S. system of units of force, weight etc. Their conversion problems. Engg. Drawing : Views of simple hollow and solid bodies with dimensions .Use of different types of lines and symbols for drawings.
18.	Overhauling steering clutches and brakes of crawler type tractors including dismantling, cleaning, checking and refitting, testing for correct functioning.	Description and working principle of the steering system on crawler type tractors. Steering by clutch and brake. Steering clutch its description, function adjustment and maintenance. Workshop Cal. & Science : Ratio and proportion shop problems. Engg. Drawing : Views of simple hollow and solid bodies with dimensions use of different type of lines and symbols for drawings.
19.	Overhauling Brakes including cleaning and inspection of all components, relinning Shoes setting and actuating shoe clearance angle. Inspecting spring of both shoe and lever Inspecting and setting hydraulic main brake including replacement of washer & oil seals, overhauling serve mechanism (as applicable) inspecting piston and valves, bleeding and adjustment of brakes. Fault tracing and remedy.	Brakes types used on tractors mechanical hand brake for parking its fitting and adjustment. Description working principle and function of hydraulic brakes. Function of master & auxiliary cylinder. Bleeding & adjustment of brakes serve system. Layout and work principle brake, shoes and drums their fitting . Knowledge of disc type brakes. Workshop Cal & Science: Work-unit of work energy power unit of power applied applied problems. Engg. Drawing : Views of simple hollow and solid bodies with dimension. Use of different types of liner and symbols for drawings.

20.	Overhauling brakes including cleaning and inspection of all components; Relining shoes, setting and actuating shoe clearance angle. Inspecting spring of both shoe and lever. Inspecting & setting hydraulic main brake including replacement of washer and oil seals.	Brakes types used on tractors mechanical hand brake for parking, its fitting and adjustment. Description working principle & function of hydraulic brakes function of master & auxiliary cylinder. Bleeding and adjustment of brakes serve system, layout and work principle –brake, shoes and drums, their fitting, knowledge of disc type brakes.
21.	Overhauling serve mechanism (As applicable) Inserting piston and valves. Bleeding and adjustment of brakes. Fault tracing and remedy.	Brakes types used on tractor, mechanical hand brake for parking its fitting and adjustment. Description working principle and function of hydraulic brakes. Function of master and auxiliary cylinders, brake fluid , filling of master cylinder Bleeding and adjustment of brakes serve system, layout and working principle brake shoes and drums and their fitting.
22.	Stripping unserviceable engine, cleaning & inspection.	Diesel engines both mobile and stationery types principle of working of diesel semi diesel, kerosene, petrol and gas engine. Two and four stroke engines, compression ignition and spark ignition engines. Single and multi Cylinder engines. Types of engines fitted on tractors : Various methods of starting on engine.
23.	Stripping unserviceable engine, cleaning and inspection.	Diesel engines – both mobile and stationery types; principle of working of diesel, semi-diesel, kerosene, petrol and gas engine. Two and four stroke engines, compression ignition and spark ignition engine Single and multi-cylinder engines. Types of engines fitted on tractors. Various methods of starting on engine.
24.	Cylinder head overhaul pressure testing phasing decarbonising engines, facing valves and valve seats and grinding valves of seats fitting valves guides, fitting springs, caps, clotters and fitting of valve seats inserts. Use of torque 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, crankshaft tapact and valves, regulator and governor etc.
25.	Inspecting and changing main bearing and big end bearings. Reconditioning of water pump . Overhauling of fuel and oil pumps.	Engine cooling methods- air and water cooling , radiator, water pump, thermostatics purpose, common troubles and remedy, maintenance of cooling system.
26..	-----do-----	Different types of lubrication systems in vehicles description of components in the system-oil filters types and uses. Lubrication oil and its properties.

Tractor Servicing

	Practical – II Tractor Servicing	Theory - II Tractor Servicing
1.	Inspecting piston and gudgeon pin etc. And fitting new rings, connecting rod. Alignment.	Diagnosing the overhauling requirement by measuring bore, ring size and wear etc.
2.	Inspecting piston and gudgeon pin etc. And fitting new rings.	Diagnosing the overhauling requirement by measuring bore, ring size and wear etc.
3.	Reassembling engine, dismantling, checking, cleaning and resetting injectors, engine testing for correct functioning.	Torque wrench and its use in tightening cylinder head bolts to specified pressure according to manufacturer's recommendation.
4.	-----do----	Fuel system types and grades of fuel used properties of fuel feed assembly and fitting of fuel tank, fuel pipes, unions adapters, filters & fuel pump. Description and function of non- return and pressure relief valves. Setting of relief to correct pressure. Air fuel ratio fuel injection – solid and air blast. Fuel injector timing and its regulation. Function and regulation of governor.
5.	Complete overhauling serviceable engines and testing for correct functioning. Checking oil pressure on different R.P.M. of the engine.	Fuel system -types and grades of fuel used properties of fuel- fuel feed. Assembly & fitting of fuel tank, fuel pipes, unions, adaptors, filters and fuel pump. Description and function of non return and pressure relief valve. Setting of relief valve to correct pressure. Air fuel ratio, fuel injection solid and air blast fuel injection timing and its regulation of governor.
6.	Complete overhauling serviceable engines and testing for correct functioning.	Fuel system types & grades of fuel used properties of fuel feed, assembly and fitting of fuel pipes unions adaptors, filters and fuel pump. Description and function of non-return and pressure relief valve to correct pressure. Air fuel ratio, fuel injection –solid and air blast, fuel injection timing and its regulation. Function and regulation of governor.
7.	Complete overhauling serviceable engines and testing for correct functioning.	Fuel system types and grades of fuel used properties of fuel. Fuel feed Assembly and fitting of fuel pipes , unions adaptors filter and fuel pump. Description and function of non-return and pressure relief valve to correct pressure . Air fuel ratio . fuel injection solid and air blast timing and its regulation of governor.
8.	Overhauling transmission assembly including master clutch , gear box, change speed mechanism, selector fork, idler gears, slide spindle drive gear, train differential, final drive, torque convertor etc. Checking, repairing, replacing parts (as necessary). Testing for correct functioning.	Transmission system in different types of tractors. Description and function of unit assemblies such as fly wheel master clutch gearbox, change speed mechanism , selector forks, drive gear chain differential axle and wheel drum etc. Comparison between transmission system of a Motor vehicle and tractor. Procedure for dismantling and assembling the torque convertor.

9.	Overhauling transmission assembly including master clutch, gear box, change speed mechanism, selector fork, Idler gears, slide spindle , drive gear, train differential , final drive, torque convertor etc. Checking , repairing, replacing parts (as necessary). Testing for correct functioning.	Transmission system in different types of tractors Description and function of unit assembly such fly wheel master clutches gear box change speed mechanism selector forks, drive gear chain differential axle & wheel drum etc. Comparison between transmission systems of a motor vehicle and a tractor. Procedure for dismantling and assembling the torque convertor.
10.	----do---	Transmission system in different types of tractors. Description and function of unit assemblies such as wheel ,master clutch gear box, change speed mechanism, selector forks drive gear chain differential, axle and wheel drum etc. Comparison between transmission system of a motor vehicle and a tractor. Procedure for dismantling and assembling the torque convertor.
11.	Tractor hydraulics and power take off mechanism. Hydraulic jacks – couplings.	Use of hydraulics different types of hydraulics and its mechanism, use of power take off for belt pulleys and other application . Types of coupling and their uses. Description of Hydraulic jack.
12.	Tractor hydraulics and power take off mechanism. Hydraulic jack couplings.	Use of hydraulics different types of hydraulics and its mechanism, use of power take off for belt pulleys and other application. Types of couplings and their uses. Description of hydraulic jacks.
13.	Overhauling track driving assembly including track frame , track roller, carrier roller	Description working principle and use of crawler type tractors. Driving mechanism of the tractors. Description, construction and function of track frame, track roller, carrier, roller, maintenance of track assembly. Starting a crawler type tractor, engine with the help of auxiliary starter engine unit precautions to be taken Care & maintenance of engines.
14.	idler, track recoil unit etc. Of crawler tractor. Testing for correct functioning.	Description, working principle and use of crawler type tractors. Driving mechanism of the tracks. Description of construction and function of track frame, track roller, carrier roller, idler track recoil units etc. Care and maintenance of track assembly. Starting a crawler type tractor engine with the help of auxiliary starter engine unit. Precautions to be taken. Care & maintenance of engines
15.	Servicing, storage Batteries electrical and starter systems.	Electrical equipment lighting arrangements in tractors (as applicable) including storing battery, dynamo, regulator switch and spotlights both front and rear Maintenance of battery.
16.	Servicing storage Batteries starter generation and regulator systems.	Electrical equipment lighting arrangement in tractors (as Applicable) Including storage battery, dynamo, regulator switch and spot- lights both front and rear. Maintenance of battery.
17.	Tracing lighting Circuit and fault rectification.	Description of lighting circuit. Setting of regulators for correct charging rate Fault finding in electrical system.

18.	Checking tractor Implements such as discs . 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.	Tractor equipment description and function of off set and tandem disc. Harrow seed drill ploughs of different types etc. Fitting and fixing of equipment. Danger in over leading and incorrect hitching of ploughs. Average life of plough shares and disc.
19.	Checking tractor implements as discs, ploughs cultivators, P.I.O., units etc. For serviceability before use and lubricating them as required. Fitting them to tractors and adjusting them for correct functioning.	Tractor equipment description and function of off set and tandem disc. Harrow speed drill ploughs of different types etc. Fitting and fixing of equipment danger in over loading and incorrect hitching of ploughs. Average life of plough shares and discs.
20.	Visit to Tractor service stations and observing use of servicing equipments.	Short description of various equipment used by service station.
21.	Exercise in driving a Tractor with different implements.	Description & function of Tractor implements & accessories. Draw bar importance offsetting draw bar to correct height use of Hydraulic lift & belly pulley mounted on tractors. Maintenance of tractor accessories. Driving servicing & maintenance of tractor Motor Vehicle act. Driving Rules.
22.	Trouble shooting in tractor driving & testing of the performance of a tractor & tractor driving with implement.	

Theory –III & Practical - III - Workshop Calculation, Science and Drawing

	W/S CAL. & SCIENCE
1.	Simple arithmetic addition, subtraction , Multiplication, Division of whole and partial number. Properties of metals and their importance in trade
2.	Fraction & decimals , conversion of fraction to decimals and vice versa/
3.	Properties of C.I. & its types, uses. properties of Non –ferrous metals and how its identifications.
4.	Properties of copper, Zinc , mild steel , aluminum etc.
5.	Properties of Brass steel , bearing metals, timber etc.
6.	Decimals, Division, multiplication
7.	Logarithm and how to find out mantisa & characteristics.
8.	Properties of C.I steel
9.	Work , power , energy
10.	Motion, velocity and problems.
11.	Volume, mass, density applied problems.
12.	Properties of metal and their applications
13.	Square roots, power conversion of decimal to British & vice versa
14.	Square roots, power conversion of decimal to British and Vice versa
15.	Multiplication power root of a number
16.	Problems on work , power & energy
17.	Ratio & percentages and problems
18.	Meaning to stress, strain, energy , elasticity
19.	Meaning of stress, strain, energy , elasticity
20.	Stress and its important factors example.
21.	Ration and proportions, ratio, finding forms and ratio proportions direct and indirect proportions
22.	Application of ratio and proportion to shop problems
23.	Mixed direct and indirect proportion problems
24.	Machines – basic principles , velocity ratio. mechanical advantages , efficient simple problems.
25.	Algebraic symbols & fundamental algebraic operations signs & symbols used in algebra, co-efficient , terms like terms and unlike terms
26.	Addition and subtraction , multiplication and division
27.	Logarithm and antilogarithms . Problems on logarithms
28.	Simple machines like winch pulley & compound axel etc. with examples.
29.	Factors and equation of algebric formula.
30.	Factors and equations-types of factorisations.
31.	Heat treatment of steel-hardening, appealing, tempering, normalizing, case hardening-standard and measurements-equations-simple simultaneous quadratic.
32.	Application construction and solution of problem by equations.
33.	Atmospheric pressure. pressuregauge gauge pressure & absolute pressure.
34.	Power & exponent & laws of exponent.
35.	Arithmetical operations involving logarithms in the computations.
36.	Problems related to trade using logarithm tables.
37.	Density of solid and liquids simple experiments and determination.
38.	Specific gravity principle of Archemedies.
39.	Relation between specific gravity and density. Simple experimental determination.
40.	Geometry- Fund-mental geometrical definitions angles and properties of angles, triangles and properties of triangles.
41.	Pythagoras theorem, properties of similar triangles.
42.	Revision of !st year topics.

43.	Revision of 1 st year topics.
44.	Rectangle, square, rhombus, parallelograms etc. and their properties.
45.	Circle and properties of circles Regular polygon.
46.	application of geometry to shop problem
47.	Heat & temp. thermometric scales their conversions.
48.	Temp. measuring instruments.
49.	quantity of specific heat of solids liquids & gases.
50.	Heat loss and heat gain with simple problem
51.	Mensurations, plain figures-triangles, square rectangles, parallelogram.
52.	Plain figures-trapezium, regular polygons, circle, hollow circles.
53.	Plain figures segment and sector of circle, ellipse fillets.
54.	Solid figures- prism, cylinder, pyramid, cone.
55.	Solid figures-frustum of cones sphere, spherical segment.
56.	Material weight and cost problems related to trade.
57.	Trigonometry, Trigonometrical ratios use of trigono table.
58.	Finding height and distance trigonometrically
59.	Area of triangle by trigonometry.
60.	Application of trigonometry to shop problems.
61.	Application of trigonometry to shop problems.
62.	Triangle of forces. Parallelogram of forces.
63.	Composition and resolution of forces.
64.	Representation of forces by vectors. Simple problem on lifting tackles like jib cranes, wall crane and solution of problem with the aid of vectors.
65.	Simple problems on strength and crank lever.
66.	Center of gravity-simple experimental determination stable-unstable and neutral equilibrium simple explanation.
67.	Friction-co-efficient of friction.
68.	Simple problem related to friction.
69.	Magnetic substances neutral and artificial magnets.
70.	Bausch principle of electricity. Method of magnetization & uses of magnets,.
71.	Basic principle of electricity.
72.	Use of fuses, conductors switches, insulator etc.
73.	Simple electric circuits. Simple calculations.
74.	Ohm's law-simple calculations-electrical insulation materials.
75.	Graphs-Abscissa & ordinates, graphs of straight line, related to 2 sets of varying quantities.
76.	Further practice on logarithm.
77.	Shop problems on estimation of material, time taken for machining a job elementary time and motion study.
78.	Shop problems on estimation of material, time taken for machining a job, elementary time and energy.
79.	Transmission of power by belt pulley and gear drive.

	ENGINEERING DRAWING
1.	Reading of simple drawing , Engineering drawing & its importance and instruments used in drawing
2.	i) Making of Title blocks as per IS 465 1988 ii) Various sizes of drawing sheets iii) Various types of pencils & sharpening methods. iv) Types of lines & their application as Per SP 46: 1988
3.	use of drawing tools simple geometrical construction

4.	Geometrical construction regular polygone circles
5.	Geometrical construction of polygon inscribed circles
6.	Curves and types of curves & their application and method of drawing curves
7.	Geometrical construction, cycloid, hyperbola parabola curves, ellipse.
8.	Free hand sketch of lines, polygons , ellipse etc.
9.	Free hand sketch of basic tools and simple geometrical const. cone, pyramid , frustum / prism etc. / sphere
10.	Construction of scale diagram, division of odd parts of scale with drawing instruments by sketch
11.	Letters and its types and drawing of letters
12.	Methods of ellipse. How to draw by drawing the instruments .
13.	Simple dimensions with technics and location of parts as per dimensions , angle , taper
14.	Transforming of various measurement, linear , Angular , Circular etc.
15.	Pictorial drawing Isometric drawings of simple block
16.	Oblique views of simple geometrical construction
17.	Isometric drawing on simple blocks
18.	Isometric drawing on completed jobs
19.	Free hand sketches of trade related hand tools cutting tools, measuring tools
20.	Free hand sketches of trades related hand tools m measuring tools
21.	orthographic drawing application of both first angle and third angle methods in representing the drawing for simple & complex machine blocks given for exercise with dimensions
22.	Orthographic drawings application of both first angle and third angle. Methods in representing the drawing for simple and complex machine blocks given for exercises with dimensions
23.	Standard method of sectioning as per IS-696. Exorcises for different sectional views on the given orthographic drawing of machine parts, castings etc.
24.	Standard method of sectioning as per IS 696. Exercise for different sectional views on the given orthographic drawing of machine parts, casting etc.
25.	Inter conversion of Isometric to orthographic drawings and vice-versa. Related problems such as V blocks-simple stepped blocks, block oriented by various machining operations etc.
26.	Interconversion of isometric, oblique drawings to orthographic drawings and vice-versa. Related problems such as V-blocks simple stepped blocks, block oriented by various machining operations etc.
27.	Free hand sketch of sectional tools.
28.	Interconversion of isometric, oblique drawing to orthographic drawings and vice-versa. Related problems such as V block simple stepped blocks, blocks oriented by various machining operations.
29.	Surface development of simple geometrical solids like cube, rectangular block, cone, pyramid, cylinder, prism etc.
30.	Interpenetrating of solids and conventional application of intersectional curves on drawings.
31.	Screw thread their standard forms as per I.S. external and internal thread conventions on the feature for drawings as per I.S.I.
32.	Sketches for bolts nuts screw and other screw screwed members
33.	Standard rivet forms as per ISI
34.	Riveted joints.
35.	Riveted joints butt
36.	Sketches of keys, cutter & pin joint.
37.	Sketches of keys, cotter and pin joints.
38.	Sketches for simple pipe unions with simple pipe line drawings.

39.	Concept of preparation of assembly drawing and detailing simple assembly and their details of trade related tools/jobs/exercises with dimensions from the given sample or model. Tool post for the lathe with screw and washer.
40.	Concept of preparation of assembly drawing and dove tailing. Simple assemblies and their details of trade related tools /jobs the exercises with dimensions from the given sample or models. Tool post for the lathe with washer and screw.
41.	Details and assembly of Vee block with clamps.
42.	Detail assembly of shaft and pulleys
43.	Details and assembly of vee blocks with clamps.
44.	Details and assembly of bush bearing.
45.	Types of curves. How to draw.
46.	Details and assembly of simple coupling.
47.	Details and assembly of a simple hand vice.
48.	Blue print reading simple exercises related to missing lines.
49.	Blue print reading simple exercises related to missing views.
50.	Simple exercises related to missing symbols.
51.	Simple exercises related to missing sections.
52.	Simple exercises to missing dimensions.
53.	Hand drawing for in-dictating switches, buttons control m/c. tool axis's quadrant point value.

Tools and Equipment List
Tractor Mechanic

SI NO	ITEMS	
1	2	No.
1. 1.	Hammer ball pein 0.75 kg.	10
2. 2.	Chisel cold flat 20 mm.	10
3. 3.	Centre punch 10 cm.	10
4. 4.	Caliper outsider spring 15 cm.	10
5. 5.	Caliper inside spring 15 cm.	10
6. 6.	Steel rule 15 cm. English & Metric.	10
7. 7.	Screw driver 75 X 10 mm.	10
8. 8.	Screw driver 30 X 1 cm.	10
9. 9.	Spanner D.E. set of 6 B.S.T.	10
10. 10.	Plier combination 15 cm.	10
11. 11.	Hand file second cut.	10

TOOLS MEASURING IINSTRUMENTS GENERAL SHOP OUTFIT :

12.	Rule steel 30 cm . to read inches & mm.	4
13.	Divider spring 15 cm.	4
14.	Prick punch 15 cm.	4
15.	Chisel cross cut 9x3 mm.	4
16.	Chisel diamond point 9 mm.	4
17.	Chisel half round 9 mm.	4
18.	Hammer ball peen 0.5 kg.	4
19.	Hammer ball peen 0.25 kg.	4
20.	Hammer copper 1 kg. With handle.	4
21.	Hammer plastic 0.25 kgs. With handle.	4
22.	Engineers square 15 cm. Blade.	4
23.	Scriber 15 cm.	4
24.	Scribing block universal.	2
25.	Marking out table 90 x 60 x 90 cm.	1
26.	Surface plate 60 x 60 cm.	1
27.	Hacksaw frame adjustable for 20. 30 cm. Blades.	4
28.	‘V’ block pair with clamps 7.5 x 3.75cm.	2
29.	Punch hollow 6.7 and 9 mm set.	2 set
30.	Punch letter set 3 cm.	1 set
31.	Punch letters set 3 mm.	1 set
32.	Hand vice up to 3.75 cm	2
33.	Screw driver eleatrician type 15 cm size.	4
34.	File flat 35 cm bastard.	4
35.	File flat 25 cm second cut.	4
36.	File flat safe edge 25 cm smooth.	4
37.	File flat 20 cm. Smooth.	4
38.	File triangular 15 cm second cut.	4
39.	File half round 40 cm second cut.	4
40.	Filesquare 30 cm. Rough	4
41.	File square 20 cm second cut.	4
	Drill twist S.S .1/8” to 1/2”x 1/64 “ set.	2 sets.
	Drill twist metric 3mm to 12 mm x 1 mm.	2 sets.
44.	Taps and dies complete set in box B.A. , B.S.W. B.S.F. American and metric	1 set each
45.	Rasp.	1
46.	H.S.S. hand reamers , parallel 8 to 12 by 1.5 mm.	2 sets.
47.	H.S.S. hand reamer adjustable 11to 12, 12 to 13, 13 to 15, 15 to 16mm.	1 set
48.	H.S.S.hand reamer 3.5 to 12.5 mm in steps of 1.5 mm set of 12.	1 set.
49.	H.S.S. machine reamers 3 to 19 mm in steps of 1.5 mm.	1 set
50.	Scraper, flat 25 cm handled.	4
51.	Scraper, half round 25 cm.	4
52.	Scraper, triangular 25 cm.	4
53.	Scraper, bearing	4
54.	Chaser hard W/V 9 to 40 T.P.I. set of 11 external.	1 Set.
55.	Chaser ,hand W/W 9 to 40 I.P.I set of 11 internal.	1 Set.
56.	Set of morse socket 0-1, 1-2 and 2-3 .	2 Set.
57.	Dial indicator to read 0.25mm.	2
58.	Screw pitch gauge with 22 pitches from 9 to 40 BTPI.	2
59.	Micrometer, outside 0” – 1”	2

60.	Micrometer outside 0.25 mm.	2
61.	Micrometer outside 50 mm to 150 mm with extension rod.	1
62.	Micrometer inside 50 to 100 mm with extension rod.	2
63.	Vernier caliper set 10" or 8" inside and outside, depth to read inches and mm.	1
64.	Safety goggles (Clear glass).	2 pair
65.	Hammer, planishing .	2
66.	Setting hammer.	2
67.	Mallet (Wooden).	2
68.	Trammel 30 cm.	1
69.	Blow lamp.	2
70.	Soldering iron 120 watt.	2
71.	Soldering iron , copper 280 gm (Fire heated).	2
72.	Snip straight	2
73.	Stake , hatchet.	
74.	Stake grooving.	2
75.	Grover 3,4,6 mm.	1 Each
76.	Nose pliers 15 cm. (round and straight).	2 Each
77.	Circlip pliers 15 cm .	2
78.	Wing compass 25 cm.	2
79.	Pat melting.	2
80.	Shovel.	1
81.	Rake.	1
82.	Poker.	1
83.	Spanner, double ended to 10 to 25 * 1.5 mm.set (BSF Size).	2 Sets
84.	Spanner, double ended set of 12 metric sizes 8 to 32 mm.	
85.	Spanner, double off-set double ended set of 7 W/W from 3 to 14 mm	2 sets .
86.	Double open ended ignition spanner of B.A. 0 x to 8x9 set of 5.	1 sets.
87.	Spanner, clyburn 15cm.	2
88.	Spanners adjustable 15 cm.	2
89.	Spanner, ring set of 6 S.A.E.	2 sets
90.	Spanner, for sparking plug 10 mm & 14 mm.	4 sets
91.	Magnet spanner set	1 sets
92.	Double open ended, spanner American A/F, sizes from 8 x 10 to 25 x 1.5 mm.	1 sets
93.	Spanner, socket, set of 8 handled , T-bar and ratchet 10,12,20 mm.	2 sets
94.	Spanner, flax for screwing up and unscrewing in inaccessible position	1 sets
95.	Double open ended tappet spanner from 11 * 12 to 16 & 17.	1 sets
96.	Drill, copper 10 x 15 1/2 mm.	2
97.	Gun, paraffin set.	1
98.	Gun, grease pressure.	1
99.	Chain & block 3050 kg.	1
100.	Tray cleaning assorted sizes.	8
101.	Drilling machine bench 1 H.P. to drill up to 12mm. Dia.	1
102.	Oil can 0.12 liter.	2
103.	Valve spring compressor universal.	1
104.	Tool, valve grinding, suction type.	6

105.	Tool, valve grinding, screw in type.	1
106.	Valve seat cutting, tools complete with guides and pilot bar (all angles).	1
107.	Valve grinding machine.	1
108.	Ex-tractor stud (EZYOUT) type.	1
109.	Compression gauge to read 0 to 115 kg/sq. Cm and vaccum gauge 0 to 75 cm .	1 each
110.	Stone, carborandum 15 x 5 x 4 cm. Smooth and rough.	1 each
111.	Injector testing set (Hand tester).	1 each
112.	Cylinder gauge capacity 6 to 15 cm.	1
113.	Ring expander and remover.	1
114.	Torque wrench (0 to 150 lbs. –ft).	1
115.	Ring groove cleaner.	1
116.	Torque wrench (0 to 20kg. Meter).	1
117.	Torque wrench (0 to 40 kg. Meter).	1
118.	Work bench 245 x 120 x 60 cm with 4 vices 12.5 cm jaw.	4
119.	Lockers with 8 drawers (Standard size).	2
120.	Metal rack 180 x 150 x 45 cm.	1
121.	Fuel pump.	2
122.	Injector pump.	2
123.	Dynamo and voltage regulator.	2 each
124.	Starter motor.	2
125.	Carburettor. (Two different types.)	2
126.	Distributor.	2
127.	Injectors (two types).	2 each
128.	Water pump & oil pump.	1 each
129.	Feeler gauge.	2
130.	Injector cleaning kit.	2
131.	Filling jig for adjusting the piston ring gap.	1
132.	Steel almirah.	1
133.	Desk or table.	1
134.	Fire extinguisher.	2
135.	Fire buckets with stand.	4
136.	Ratchet brace.	1
137.	Drill post.	1
138.	Twist drills for ratchet brace 6 to 20 by 1.5 cm.	1 set
139.	Tachometer (Counting type)	1
140.	Brake drum spring balance belt etc. For performance testing of engine.	1 set
141.	Lifting jack screw type 3050 kg.	4
142.	Equipment puncture, in box.	1
143.	Spray gun set with accessories.	1
144.	Grinder with two 18 cm wheels with twist drill grinding attachment.	1
145.	Compressor capacity 12 c.ft. piston type with pressure gauge (For inflating of tubes etc).	1
	Hydraulic jack HI-LIFT type.	1
	Grawler type tractor fitted with diesel with diesel engine with standard accessories and special tools (50 to 60 draw-bar H.P).	1
	Wheel type tractor fitted with diesel engine with standard accessories and special tools (30 to 40 draw-bar H.P.).	1

	Trailing type three bottom mould board 30 cm. Size with coulter and jointer.	1
	9-tine cultivator spring loaded.	1
	3-furrow disc plough with scrapers.	1
	Ridger.	1
	Rear axle assembly T-gear box steering box assembly of the diesel engine tractor.	1 set Each

	List of Practical for teaching purpose	
1.	2.	
1.	Introduction to the trade and safety precautions.	
	BENCH FITTING :	
2.	Introduction and use of hand tools.	
3.	Filing to line within an accuracy of + 0.05 mm.	
4.	Chipping.	
5.	Grinding of chisels.	
6.	Use of calipers.	
7.	Use of precision measuring instruments.	
8.	Care and maintenance of tools.	
9.	Scraping flat surfaces.	
	Drilling Tapping and Reaming :	
10.	Drilling including blind holes.	
11.	Taping by hand.	
12.	Use of stocks and dies.	
13.	Hand reaming .	
14.	Machine reaming.	
15.	Use of adjustable reamers.	
16.	Use of taper reamers.	
17.	Removal of broken studs.	
	TURNING :	
18.	Care and operation of center lathe.	
19.	Tool grinding (lathe)	
20.	Use of chucks.	
21.	Turning within an accuracy of + 0.05 mm.	
	SHEET METAL WORK AND WELDING :	
22.	Bending and rolling.	
23.	Soft soldering.	
24.	Brazing.	
25.	Pipe bending.	
26.	Fitting of nipples and unions.	
27.	Simple welding of sheet metal.	
28.	Arc welding practice.	
	POWER UNIT OF TRACTOR :	
29.	Handling of tractor.	
30.	Engine removal.	
31.	Engine dismantling.	
32.	Checking of components of an engine.	
33.	Checking and fitting of main and big end bearings.	
34.	Fitting of pistons and rings.	
35.	Engine assembly.	
	COOLING SYSTEM:	
36.	Checking of cooling system.	
37.	Overhauling water pump and radiator.	

	FUEL SYSTEM :
38.	Study of fuel system of tractor.
39.	Bleeding fuel system.
40.	Fault finding & repairs.
	TRANSMISSION SYSTEM :
41.	Clutch overhauling.
42.	Gear box overhauling.
43.	Overhauling of rear axle.
	STEERING AND BRAKES :
44.	Overhauling and adjustment of steering and brakes.
	HYDRAULIC SYSTEM :
45.	Overhauling of hydraulic system.
	UNDER CARRIAGE :
46.	Track adjustment.
47.	Minor repairs of tyres and tubes.
	ELECTRICAL SYSTEM :
48.	Maintenance & minor repairs of starter , dynamo and regulators.
49.	Care and maintenance of batteries and lighting system.
	LUBRICATION SYSTEM :
50.	Lubrication system fault finding & remedies.
51.	Reconditioning of oil filters.
	TRACTOR IMPLEMENTS :
52.	Checking implements for serviceability.
53.	Hitching of implements.
54.	Application adjustment and maintenance of implements.
55.	Driving of tractor with implements.
	TROUBLE SHOOTING :
56.	Fault finding remedies.
57.	Use of manuals and catalogues.
58.	Preparation of job cards and estimates.
	SHOP TRAINING –2 YEARS :
59.	Instructions to safety precaution on shop floor.
60.	Use of precision measuring instruments.
61.	Care and maintenance of tools.
62.	Use of center and pilot drills.
63.	Tapping in lathe.
64.	Reaming in lathe.
65.	Joining metals by Arc welding.
66.	Servicing of air cleaners of different Tractors.
	COOLING SYSTEM :
67.	Overhauling of radiator.
68.	Overhauling of water pump.
69.	Flushing of cooling system.
	AIR INTAKE SYSTEM :
70.	Refacer of valves on a valve seats.
71.	Cutting and grinding of valve seats.
72.	Tappet clearance adjustments.
73.	Removal and fitting of valve seat inserts.
	FUEL SYSTEM :
74.	Bleeding Fuel system.
75.	Overhauling of feed pump.
76.	Testing of injectors and overhauling.
77.	Overhauling of fuel pump.

78.	Check and service filter.
79.	Governor service filter.
	POWER UNIT :
80.	Measurement of ovality & taperness in cylinders and crank shaft.
81.	Measurement of piston ring end gap.
82.	Checking of piston groove for wears.
83.	Reconditioning of cylinders.
84.	Reconditioning of crankshaft.
85.	Placing rings on pistons.
86.	Fitting new liners and reboring where necessary.
87.	Removal of ridge from cylinder liner.
88.	Check , clearance between piston and cylinder bore.
89.	Pressure test of cylinder block.
90.	Method of tightening cylinder head bolts ,main and big end bearing bolts.
91.	Detect, cracks in cylinder head and cylinder block..
92.	Checking oil clearance in main bearings .
93.	Engine –Timing .
94.	Checking oil clearance in big end bearings.
95.	Connecting rod alignment.
	LUBRICATION SYSTEM :
96.	Checking of wearing gears & housing of oil pump.
97.	Setting oil pressure relief valve.
98.	Cleaning of oil filters.
99.	Fault finding and remedies.
100.	Checking for oil leaks in crank gear, value , cover joint etc.
	ENGINE ASSEMBLY :
101.	Installation of crankshaft in cylinder block.
102.	Fitting main bearings.
103.	Fitting pistons and connecting rods.
104.	Fitting big end bearings.
105.	Fitting of head assembly.
106.	Fitting of camshaft timing gear oil pump assembly.
107.	Fitting outside components and completing the engine assembly.
	CLUTCH :
108.	Checking wear in clutch assembly components.
109.	Adjustment of free play.
110.	Clutch plate relining.
111.	Attending minor repairs.
	TRANSMISSION SYSTEM :
112.	Checking different components for proper operation.
113.	Fault finding and remedies.
114.	Overhauling of final drive and differential.
115.	Transmission (gear box) overhauling.
	BRAKE & STEERING :
116.	Checking of brake components for serviceability.
117.	Brake service including, replacement of lining.
118.	Fault finding, causes and remedies.
119.	Checking wear in ball socket joint of steering.
120.	Checking wheel alignment toe-in and toe-out.
121.	Care and maintenance of steering system.
122.	Checking and overhauling of power steering.
	WHEEL EQUIPMENT :
123.	Minor valconsing repairs on tyres and tubes.

124.	Water blasting of wheels.
125.	Wheel track adjustment.
126.	Remove and refit wheel.
127.	Check and service under carriage components.
	ELECTRICAL SYSTEM :
128.	Wiring of tractors.
129.	Checking of dynamo and minor repairs.
130.	Checking of self starter and minor repairs.
131.	Minor repairs on regulators.
132.	Care and maintenance of electrical system.
133.	Battery maintenance.
134.	Pre starting inspection.
	HYDRAULIC SYSTEM.
135.	Dismantling hydraulic pump checking for repairs.
136.	Dismantling distributors, cam cylinder and actuating mechanism.
137.	Fault finding and carry out minor repairs.
	TROUBLE SHOOTING
138.	Fault finding, causes and remedies .
139.	Use of service manuals.
140.	Use of parts catalogues.
141.	Preparation of list of parts for attending quick repairs.
142.	Preparation of job cards and cost estimates.
143.	Preparation of maintenance schedules for different makes of tractors.
144.	Running in and engine test.
