

MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI

1	Name of Course	Certificate Course in Diesel Mechanic				
2	Max no.of Students	25	Course Code - 306207			
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 diesel engine, To do maintainance of diesel engine vehicles				
10	Employment opportunities	work as Mechanic in garages, automobile workshop, service stations etc, can start own 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	30620711	Diesel Mechanic	Theory - I	3 Hrs	100	35
2	30620712	Diesel Engine	Theory – II	3 Hrs	100	35
3	30620713	Workshop Calculation, Science and Drawing	Theory – III	3 Hrs	100	35
4	30620721	Diesel Mechanic	Practical – I	3 Hrs	100	50
5	30620722	Diesel Engine	Practical – II	3 Hrs	100	50
6	30620723	Workshop Calculation, Science and Drawing	Practical - III	3 Hrs	100	50
				Total	600	255

Diesel Mechanic

	Theory - I - Diesel Mechanic	Practical - I - Diesel Mechanic
1.	General introduction to the course-duration of the course and course content. Study of the syllabus general rules pertaining to the institute facilities available Hostel .Recreation and medical facilities- library working hours. Time table.	Familiarization with the institutes. Importance of the trade machinery used in the trade – types of work done by students in the institute shoo floor of the institute.
2.	Importance Safety or 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.	Description of safety Equipment their use – safety rules to be observed in an Automobiles repair shoo. Accidents their causes works of fire. Fire Extinourshers – Familiarization of the tools machinery available in the shop their use and up keep importance of maintenance cleanliness of workshop. Tools, Jacks. Trays and Hoses.
3.	Systems of measurement conversion of English into metric measurement and vice versa – marking media – Chalk mechanic Blue Red lead and Tools used for marking steel rule. Try Square, caliper and dividers, scriber prick and centre punch- Hammer and Chisel – uses and maintenance – safety precautions in handling Grinding machines.	Demonstration of the use of Fitter's Hand Tools marking off with steel rules calipers, scriber, dividers Dot and center punch – Chipping in marked lines in a given piece Sharpening of Chisels. Center punch and Dot punch to correct Angles.
4.	Types of hacksaw frames and Blades-Their selection and uses- types of files and their uses. Care and Maintenance of files . Types and sizes of Drills- cutting Angles and speeds of Drills – Calculation of Tap drills sizes.	Hacksawing Filling to given Dimensions – Filling True and square – Practice different types of filling operations – marking and drilling clear and Blinds Holes sharpening of Twist Drills Safety precautions to be observed while using a drilling machine.
5.	Tapes and Dies – Description use of different types Tapes and Dies – Use of 'V' Threads – precautions while using taps and Dies – Description and use of different types of Scrapers. Reamers and Emery papers.	Tapping a Clear and Blind Hole – Selection of tape drill Size – use of Lubrication – Cutting Threads on a Bolt/ Stud – Adjustment of two piece Die – Reaming a hole/ Bush to suit the given pin/ shaft – scraping a given machined surface.
6.	Construction and method of reading micrometers (Internal and external) and Vernier Caliper correct handling of micrometers and vernier Calipers, Reading of vernier Scale – Description and use of combination set care and maintenance of micrometers, vernier calipers, combination set.	Measuring diameter of pistons main journals, Crank – pins, king pin big end and main bearings cylinder Bores with micrometers and Vernier Calipers – measuring with and Thickness of machined flat and round bars – measuring of valves angles with protractor head locating centers of a round bar with center head.

7.	Sheet metal workers hand tools their description and uses – description of simple soldering and brazing, Fluxes used for common joints – Types of sheet metal joints – their uses.	Joining of metal parts by Soft Soldering – Simple marking out on sheet metal and cutting – Bending and folding.
8.	Sheet and wire gauges the blow lamp and its uses pipe fitting Explanation of various common metal sheets used in sheet metal shop.	Practice in silver soldering pipe bending, Annealing of pipes fitting Nipples Unions soldering and Brazing of pipes.
9.	General description and construction of diesel engine – Characteristics and Classification working principles of 4 stroke cycle diesel and Petrol engine comparison between petrol and diesel engine.	Exercise involving use of wrenches, pliers, screw drivers and pliers – cleaning and lubrication of engine parts, location and identification of engine components.
10.	Two stroke cycle diesel engine types of scavenging uniflow and loop flow Scavenge opposed copper piston engine differences between two strokes and 4 stroke cycle diesel engines.	Practice on unserviceable diesel engine, removing jammed nuts and broken studs reconditioning and damaged stud hole fitting oversized studs.
11.	Engine details – cylinder materials – cylinder liners and their advantages, cylinder heads, description function, cares and maintenance – Location combustion chamber in cylinder heads and also heater plugs and port and valve arrangements.-	Selection of materials for gaskets and packing – use of locking devices lock nuts . cotters, split pins and circlips lock rings- location where they are used inspection and checking leakage of air, fuel oil and exhaust in the engine
12	Combustion chambers pumps , open and closed types, advantages, and disadvantages compression ratio & compression pressures, compression testing of cylinders and analysis of results & its importance	Practice on starting and stopping of diesel engines Use of speed counter in determining the engine speed – running of engine on load checking temperature fuel and oil compression testing of cylinders
13	Need for maintenance check up in diesel engine- preparation of maintenance schedule from charts of popular makes of engine	Maintenance check – daily weekly monthly for different types of engines writing up of inspection schedules—Maintenance of log sheets details of maintenance
14	valves & valves operation- Mechanism- parts & function of each valve timing diagram camshaft and timing gears – types of drives used in engines chain tension and its importance cylinder head and manifold construction and function – water jackets passages	Remove , rocker arm assembly manifolds- and cylinder head- removing valves and its parts – cleaning & decarbonising - checking valve seats & valve guide – reconditioning valve seats and refacing valves- lapping valves on its seat- testing leaks of valve seats for leakage – inspection of cylinder head and manifold surfaces for warping and cracks

15	Description and function of valve parts-maintenance Materials used –necessity of valve clearances prescribed by makers of engine – effects of incorrect clearances-common troubles and remedy –reason for wrapping of cylinder head	Dismantle rocker arm assembly clean & check shaft- bushes , posts and rocker arm for wear and cracks and reassemble. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence , refit cylinder head and manifold & rockarm assembly , adjustable valve clearances, starting engine after decarbonising
16	Piston and piston rings Function-types and material . used recommended clearances for the rings and its necessity-precautions while fitting rings- connecting rods-types function and material used- methods of fixing gudgeon pin on small end method of lubrication provided for small end bushes	Removing piston & connecting rod from engine-examine-piston ring lands for wear-examine piston skirt for cracks & distortions, clean oil holes - check connecting rod for bend and twist and parent bore for taper and ovality and gudgeon pin bushes for wear-check elongation of cap fixing bolts
17	Crankshaft- construction & functions material used - arrangement of crank pins and main journals-balancing methods- fly wheel - construction & its function and material used Rim marks and balancing. Elementary knowledge of function of clutch & coupling units attached to flywheel.	Removing crankshaft and camshaft from engine -checking crankshaft for bend & twist -checking oil retainer and thrust surfaces for wear-measure crank shaft journal for wear -checking flywheel and mounting flanges, spigot, bearing-check vibration damper for defects -check cam shaft for bend & crank
18	Description & function of cylinder block-material used - cylinder liners -& details crank case and oil pan and their construction water jacket passages & wall thickness bolt hole dimensions for cylinder head fixing provision for mounting accessories like oil pump, water pump filters - oil flow passages and cleaning plugs	Checking cylinder blocks surface -measure cylinder bore for taper & ovality- check main bearing parent bore for taper & ovality clean oil gallery passage and oil pipe line-check main bearing cap bolt holes check cam shaft, bearings and tappet bore - descale water passages and examine Welsch plugs check cylinder head for warping.
19	Engine Bearings-classification and location materials used & composition of bearing materials - Shell bearing and their advantages - special bearings material for diesel engine application bearing failure & its causes - care & maintenance.	Fixing bearing inserts in cylinder block & cap check nip and spread clearance & oil holes & locating lugs fix crank shaft on block-torque bolts - check end play remove shaft - check seating, repeat similarly for connecting rod and Check seating and refit.
20	Friction - its meaning and importance, methods to reduce friction in engines - use of lubricants - oil grease high detergent oil for diesel engine lubrication - properties of lubricants.	Overhauling oil pump , oil filters oil coolers aircleaners and airfilters and adjust oil pressure relief valves - changing oil in the sump, repairs to oil flow pipe lines and unions.

21	Need for lubrication system for diesel engines - types used and layout of the system by pass & full flow arrangement-types of oil pumps oil filters, oil coolers, common troubles - care and maintenance	Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per makers recommendations for engines.
22	Engine assembly procedure need for cleanliness and special tools and gauges used for engine assembling, practice - periods of decarbonising and overhauling engine in terms of hours of run or mileage - running in procedure of overhauled engines.	Reassemble all parts of engine in correct sequence and torque all bolts & nuts as per markers, recommendations for the engine - Fit accessories & start and run the engine on stands
23	Cylinder liners - construction & purpose - material used and finish provided types of liners in use - methods used to fit the same in cylinder bore, advantages of wet and dry liners wear pattern & allowable wear cylinder wear and its causes.	Removing cylinder liners from scrap cylinder block, practice in measuring and refitting new liners as per makers recommendations precautions while fitting new liners.
24	Need for cooling an engine general description & types of air and liquids - cooling used in engine - layout of cooling system and parts in the layout-function of parts like radiator -thermostat & need to maintain engine working temperature.	Removing radiator and water pump from engine, cleaning & reverse flushing. Radiator, testing thermostat and refitting on engine-overhauling -water pump refitting - adjusting fan belt tension and connecting water pump with radiator with hoses & flushing cooling system of the engine.
25	Description & operation of Air compressor and exhaustor attached to transport vehicle engines - common troubles & maintenance of both their specific application for the brakes of the vehicle.	Dismantling air compressor and exhaustor-cleaning all parts - measuring wear in the cylinder and blades-reassembling all parts and fitting them in the engine.
26	Description of internal & external engines - different types of I C Engines parts of an IC Engine-4 stroke O T T O cycle engine - 2 stroke petrol engine - difference's between the two k- importance of valve timings and parts of valve operating system description and operation.	Dismantling a petrol engine in a systematic procedure - clean & inspect all parts for wear & reusage - check oil clearance reset main and connecting rod bearings - check cylinder wear & examine piston and rings connecting rods-and crank shaft reconditioning if necessary - reassemble all parts in sequence as per makers, recommendation - adjusting valve tappets-start & adjust slow speed of the engine.
27	Brief Description of engine components - their location and function - cooling and lubrication system -parts and layout of the system -layout of parts in the system & function of each part Ignition system in a petrol engine system Layout & Parts of ignition system and functions of each part working of the system importance of Firing order and Adv. Retard mechanism.	Practice on engine tune up operations involving testing vacuum and compression of engine, adjusting valve clearance, setting and adjusting ignition timing adjusting carburetors for slow speeds Overhauling AC Pump & Testing for its working cleaning spark plugs & testing and setting as per maker's recommendation starting engine. Adjusting slow speed.
28	Visit to Local Industrial Plants and Factories.	

Diesel Engine

	Theory - II - Diesel Engine	Practical - II - Diesel Engine
29	Step by step method of diagnosis of troubles in the lubrication and cooling system-reasons for engine overheating & remedies for the same. Crank case dilution and crankcase ventilation flow test rate recommended for radiator.	Trouble shooting in cooling and lubrication system/engine checking up and connecting oil and water leaks - changing defective packing and gaskets - testing functioning of thermostat.
30	Reasons for development of noises in the engine components - rectification, methods of assembling practice to be followed during engine overhauling as per makers shop manual.	Diagnosis of engine faults like main bearing - noises piston pin noise flywheel knock & valve noise- and crank noises and diesel knock.
31	Reasons for excessive exhaust smoke overheating vibration, missing & hunting noises in an engine methods of eliminating these noises for smooth working of the engine.	Diagnosis of engine faults like smoky, exhaust, over - heating, heavy vibration, missing cylinders, exhaust noise, hunting characteristics of engine and erratic or irregular idling.
32	Starting methods used for starting diesel engines used for transport, agricultural marine, industrial purposes-brief description. Of each method - methods to eliminate starting difficulty in a diesel engine.	Diagnosis of reasons for starting difficulty in a diesel engine and rectifying the faults.
33	Necessity of strong foundations for diesel engine-details for diesel engine -details of foundation bolts & nuts-composition of a good mix for grouting foundation bolts dimensions of pits & Boxes to suit engine base-purpose of template-need for aligning the engine on HD Bolts.	Practice in erecting over - hauled engines on stands & foundations preparation of templates of foundation holes of the engine base-preparation of hold - down, bolt and Nuts and boxes for foundation pits-starting engine on foundation and observing vibrations.
34 to 35	Fuel feed system in diesels -Air injection and airless injection. Systems their general description and lay out importance of water separators - constructional details of water separators.	Cleaning fuel tanks-checking leaks in the fuel lines-soldering & repairing pipe lines and Unions - brazing nipples to high pressure line studying the fuel feed system in diesel engines-draining of water separators
36 to 37	Fuel filters-types & constructional details - reasons for using no. of filters sequence of replacement of filter elements Importance of Diesel fuel cleanliness-types of diesel fuel HSD & LSD Description of O. F. valves & their functions.	Bleeding of air from the fuel lines-servicing primary & secondary filters-removing filters elements -in pressure filters.
38 to 39	Constructional details of fuel injection pumps, feed pumps and governors-explanation of function and operation.	Dismantling an unserviceable fuel injection pump - feed pump governor studying the parts and reassemble general maintenance of F. I. Pumps.
40 to 41	Importance of timing the pumps with engine closed slot cross coupling marks vernier scale on coupling advancing and retarding methods effect of over advancing-timing device and its details - critical adjustments of Jerk-pump phasing and calibration - adjustment for maximum speed idle speed & smoke limits.	Removing a fuel injection pump from an engine-refit the pump to the engine re-set timing - fill lubricating-oil start and adjust slow speed of the engine.

42	Governors - pneumatic type- construction & operation-venturi unit and its purpose and action-precautions to be observed in attending to the governor-definition of rated speed - maximum speed-over run of governors-purpose of auxiliary venturi in the Governor-principle of idling damper.	Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking performance of engine with off load adjusting timings.
43.	Mechanical governors Their construction, function and operation under different load and speed and maintenance- common troubles and remedies.	Start engine- adjusting idle speed of the engine fitted with mechanical governor checking- high speed operation of the engine.
44,45.	Fuel injection Nozzles description and operation of each type spray angles and orifices and their characteristic-injector tester- construction and function types of tests and their purpose. Effects of incorrect setting of nozzles on engine performance.	Checking performance for missing cylinder by isolating defective injectors and test-dismantle and replace defective parts and reassemble and refit back to the engine importance of correct torqueing-while assembling the unit and also fitting on to the engine.
46.	Importance of periodical maintenance and upkeep of shop equipment's- preventive maintenance to avoid sudden and major failure- preparing maintenance charts for machineries and follow up.	Repairing of grease guns oil cans-oil spray guns & other shop floor equipment Maintenance of drill press pedestal grinder, valve reface and air compressor.
47	-do-	Repairing of injector tester, horses, jacks and stands vacuum & compression gauges maintenance of washing pumps and hydraulic presses phasing and calibrating machine.
48	Simple electrical circuit-series & parallel circuits-identification of alternating-current and direct current meters-insulators and conductors-types of resistance's - ohm's law and its application-common electrical terms and symbols - primary and secondary cells-lead acid battery description - construction - common troubles and remedy.	BASIC ELECTRICAL WORK Practice in joining wires & 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 connecting battery to charger.
49	Description of electrical circuits - ignition system and the components- purpose of induction coil, condenser, spark plugs - common troubles in ignition circuit and remedy.	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.
50	Description of charging circuit - operation of dynamo and regulator Unit - Ignition warning lamp-troubles & remedy in charging system.	Removing dynamo from vehicle dismantling, cleaning checking for defects, assembling and testing for motoring action of dynamo & fitting to vehicles.
51	Description of starter motor circuit-constructional details of starter motor-solenoid switches -common troubles and remedy in starter circuit	Removing starter motor vehicle and overhauling the starter motor – testing of starter motor

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, fining 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 polygons 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.

LIST OF TOOLS AND EQUIPMENTS

SL. NO.	TRAINEE'S KIT	FOR INSTRUCTORS	
1.	Hamme Ball pein 0.75 K.g.	1	5
2.	Chisel Cold flat 19 mm.	1	5
3.	Centre punch 10 cm	1	5
4.	Steel rule 15 cm. English and metric	1	5
5.	Screw driver 30 cm. * 9 mm. Blade	1	5
6.	Screw driver 20 cm. * 9 mm. Blade	1	5
7.	Spanner D .E . set of 12 metric 8-32 mm	1	5
8.	Pliers combination 15 cm.	1	5
9.	Hand file 20 cm second cut	1	5
10.	Feeler Gauge 20 blade	1	5
11.	Ring spanner set of 12 metric 8-32 mm	1	5
12.	Steel tool box with locks and keys	1	5

TOOLS MEASURING INSTRUMENTS AND GENERAL SHOP OUTFIT

1)	Rule steel 30 cm	1
2)	Dividers spring 15cm	1
3)	Prick punch 15 cm	1
4)	Chisel cross cut 9x 3 mm	1
5)	Hammer ball pein 0.5 kg	1
6)	Hammer copper 1 kg with handle	1
7)	Engineers square 15 cm blade	1
8)	Scriber 15 cm	2
9)	Scriber block universal	1
10)	Marking out tables 90 cm x 60 cm. 90 cm (high)	1
11)	Surface plate 60 x 60 cm blades	1
12)	Hacksaw frame adjustable for 20-30 cm blades	2
13)	V block 75 x 38 mm pair with clamps	2
14)	Punch, hallow ,6,7,8,9,10.5 and 12mm set	2 sets
15)	Punch figure set 3 mm	1 set
16)	Punch figure set 3 mm	1 set

17)	Hand vice 3-7 mm	2
18)	Screw driver , Electrician type 15 cm size	2
19)	File , flat 35 cm bastard	1
20)	File , flat 25 cm second cut	1
21)	File flat 20 cm smooth	1
22)	File, flat safe edge 25 cm smooth	1
23)	file, triangular 15 cm second cut	1
24)	File, half round 40 cm. Second cut	1
25)	File round 30 cm second cut	1
26)	File square 20 cm, second cut	1
27)	Drill , twist, metric 3mm x 12 mm 1mm	1 set
28)	Taps and dies complete set in box B. A . B.S.W. B.S.F. American and metric	1 set
29)	H.S.S. Hand reamer, adjustable 10.5 mm to 11.25 mm 11.25 mm to 12.75 mm 12.78mm to 14.25 mm and 14.25 to 15.75 mm.	1 set
30)	Scraper, flat 25 cm handled	1
31)	Scraper half round 25 cm	1
32)	Scraper triangular, 25 cm	1
33)	Scraper bearing	1
34)	Sets of more socket 0-1 1-2 and 2-3	1 set
35)	Micrometer ,outside 0 to 25 mm	1
36)	Micrometer outside 50 mm to 75 mm, 75 mm to 100mm	1 each
37)	Micrometer with extension rod (Inside) 55mm to 150 mm	1
38)	Vernier calipers set 25 or 20 cm inside outside depth to read both inches and in mms.	1
39)	Safety goggles (clear glass)	2 pair
40)	Hammer , planishing	1
41)	Setting hammer	1
42)	Mallet (Wooden)	1
43)	Trammel 30 cm	1
44)	Blow lamp 0.5 liter	1
45)	Soldering iron 120 watts.	1
46)	Soldering iron, copper 225 gms (Fire heated)	1
47)	Pliers nose (round and straight)	1 each
48)	Ship straight	1
49)	Pot, melting	2
50)	Poker	2
51)	Spanners, double ended set of 12 metric size 8 to 32 mm	1 set
52)	Spanner, double off-set double ended set of 7 W/W from 3 mm to 13.5 mm	1 set
53)	Double open ended ignition spanner of B. A. 0 x 1 to 8 x 9 set of 5	1set
54)	Spanner, clyburn 15 cm	1
55)	Spanners, adjustable 20 cm	1
56)	Spanner , ring of set of 6 S.A.E.	1 set
57)	Spanner for sparking plug 14 mm	1 set
58)	Magneto spanner set with 8 spanners	1 set
59)	Double open ended spanner American A/F size from 7.5 mm x 9 mm to 19 mm x 20.5mm set of 6.	1
60)	Spanner socket set of 8 handled T. Bar ratchet	2
61)	Spanner, T. Flex for screwing up and unscrewing in inaccessible position	1
62)	Double open ended Tappet spanner from 10.5 mm x 12 mm to 16.5 mm x 18 mm set of four	1 set
63)	Drift, copper 10 mm x 150mm	2

64)	Gun, paraffin pressure	1
65)	Gun grease pressure	1
66)	Chain and block 1016 kg capacity	1
67)	Tray cleaning 45 x 30 cm	10
68)	Drilling machine bench to drill up to 12 mm dia.	1
69)	Oil can 0.5 liter	1
70)	Lifter , valve spring	1
71)	Tool valve Grinding, suction type (consumable tool)	5
72)	Valve seat cutting tools complete with guides & pilot bar (all angles) in a box	1 set
73)	Extractor, stud "Ezy out" Type	1
74)	Compression gauge to read 120 kg/sq. Cm and vacuum gauge 0 to 75 cm	1 each
75)	Stone, carborandum 15 x5 x 3.75 cm rough and smooth (consumable)	2
76)	Cylinder Gauge, capacity 6.25 cm * 15 cm	1
	Forge with chimney and Trough fitted with blower	1
77)	Ring Expander and remover.	1
78)	Torque wrench (0 to 75 kg meter)	1
79)	Work bench 250 * 120 * 75 cm with 4 vices of 12.5 cm	4
80)	Lockers with 8 drawers (Standard size)	2
81)	Metal Rack 180x150 x 45cm	2
82)	Fuel Feed pump	2
83)	Fuel injection pump	2
84)	Carburetor (Two different types)	2 each
85)	Water pump and oil pump	1 each
86)	Filling jig for adjusting the piston ring gap	1
87)	Steel almirah	1
88)	Black board with easel	1
89)	Desk or table	1
90)	Fire extinguisher	2
91)	Fire buckets with stand	4
92)	Tachometer (Counting type)	1
93)	Compressor air piston type (vehicular) and exhauster unit	1 each
94)	Clutches, different types such as come type, disc type	1 each
95)	Dynamo and voltage regulator	1 each
96)	Starter motor	1
97)	Injectors	2 Nos.
98)	Battery - 12 volt	2 "
99)	Chair.	1 No.
100)	Distributor Assembly	2 Nos.
	Puller set universal for bearings and bushes.	1 set
	Lifting jack, srew type 3048 kg.	2 Nos.
	Feeler Gauge.	2 Nos.
	Piston ring compressor.	2 Nos.
	Valve key inserted.	1
	Connecting rod alignment fixture.	1
	Valve refacer.	1
	High rate discharge tester.	1
	A.V.O. meter.	1
	Injection testing set (Hand operated).	1
	Injector cleaning kit.	2 sets.

GENERAL MACHINERY

1.	Grinder with two 18 cm wheels with twist drill grinding attachment.	1
2.	Arbor press hand operated 2 ton capacity.	1
3.	Motor lorry in running condition (Diesel) Indian make).	1
4.	Diesel engine cut away model to show working parts for demonstration (One stroke & one 4 stroke).	1 each
5.	Diesel Engine 4 stroke Multicylinder 4/6 vehicular type Indian Make contemporary—model.	1
6.	Petrol engine (Running condition,car type) Indian make.	1 Nos.
7.	Diesel engine (Running condition) Stationary type.	1 Nos.
8.	Petrol engine vertical (2 stroke) Motor cycle/Scooter type 1.5 hp Indian make contemporary model.	1
9.	Grower	1
10.	Battery charger.	1
11.	Timing lighter.	1
12.	Hydrometer (Consumable Tool)	5
13.	Washing pump-reciprocating type electrically operated with 3 hp motor – 272 litre tank.	1
14.	Portable lifting crane one ton capacity with chain block and tackle arrangement.	1
15.	Trolley type portable air compressor 1 single cylinder with 45 litres capacity Air tank all accessories and with working pressure 6.5 KG/Sq.cm ² .	2
