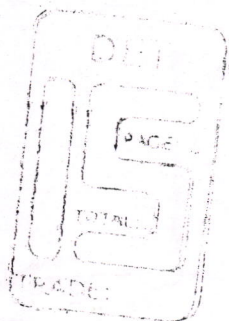


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SYLLABUS FOR

BENCH FITTER

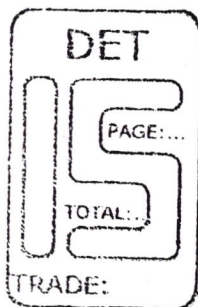
**UNDER CODE OF REGULATIONS FOR
INDUSTRIAL SCHOOLS**



**AS APPROVED BY
DEPARTMENT OF EMPLOYMENT AND
TRAINING, CHEPAUK,
CHENNAI - 600 005.**

.....2005

**LIST OF COMMITTEE MEMBERS
FOR THE TRADE OF *BENCH FITTER***



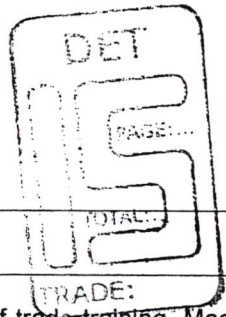
MEMBERS AND EXPERTS

1. THIRU. S.SUBBIAH M.E.
RJD COIMBATORE REGIN.
2. THIRU. C. RAVICHANDIRAN B.E., M.B.A.
PRINCIPAL, GOVT. ITI, HOSUR
3. THIRU. S. MANI B.E.
T.O., GOVT. ITI, HOSUR
4. THIRU. S.SUTHAKAR SINGH
A.T.O., GOVT ITI, HOSUR
5. THIRU. R.G.BALASUBRAMANI
J.T.O., GOVT. ITI, HOSUR

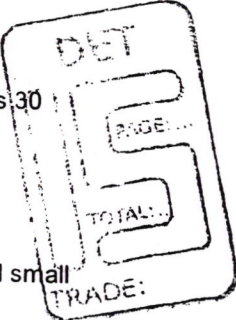
COURSE DETAILS

Name of Trade	: BENCH FITTER
Qualification	: VIII Pass
Age	: 14-40 Years
Duration	: 1 Year
Number of Trainees	: 20
Number of Practical hours	: 32 hrs. per week
Number of Theory Hours	: 8 hrs. per week
Number of Workshop Calculation hours	: 2 hrs. per week.
Number of Engineering Drawing hours	: 2 hrs. per week
Space Required	
Workshop	: 450sq. feet
ClassRoom	: 200 sq. feet
Power Required in KW	: 3 k.w.

SYLLABUS FOR : BENCH FITTER
WEEKWISE PRACTICAL SYLLABUS



WEEK NO.	SYLLABUS
1.	Familiarisation with the Institute Importance of trade training, Machinery used in the trade, types of work done by trainees in the trade, introduction of safety equipment and their uses.
2.	Marking out lines gripping suitably in vice jaws, hack sawing to given dimensions sawing different type of metals of different sections
3.	Filing Channel Parallel Filing Flat and Square (Rough finish).
4.	Filing practice, surface filing marking off straight and parallel line with old leg calipers and steel rule, marking practice with dividers old leg calipers and steel rule (circles, arcs, parallel lines).
5.	Marking off straight lines and arcs using scribing block and dividers chipping flat surface along a marked line.
6.	Marking, filing, filing square, use of tri-square.
7 to 9.	Marking according to simple blue prints location position of hole scribing lines on chalked surfaces with marking tools Joining st.line to an arc.
10.	Filing flat, square, and parallel to an accuracy of 0.5mm. Chip curve along a line-mark out.
11.	File thin metal to an accuracy of 0.5mm chip chamfer, grooves and slots.
12.	Saw along a straight line, curved line, on different sections of metal. Straight saw on thick section. M.S. angle and pipes.
13.	File steps and finish with smooth file accuracy $\square 0.25$ mm. File and saw on M.S. Square and pipe welds.
14.	File radius along a marked line (Convex & Concave) & match. Chip sheet metal (shearing). Chip step and file.
15.	Punch letter and number (letter and number punch) use of different punches.
16.	Mark off and drill through holes-drill on M.S. flat, file radius and profile to suit gauge.
17.	Step fit, angular fit, file and make angle surfaces make simple open and sliding fits.
18.	Enlarge hole and increase internal dia. File cylindrical surfaces. Make open fitting of curved profiles.
19.	Make the circles by bridging a previously drilled hole.
20.	Inside square fit, make combined open and sliding fit, straight sides 'T' fit.

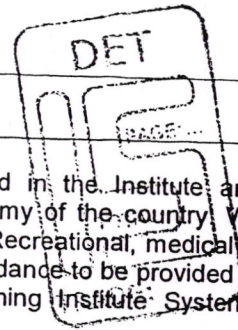
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- 
21. File fit combined open angular and sliding sides. File internal angles 30 minutes accuracy open angular fit.
 22. Make sliding fit with angles other than 90° sliding fit with an angle.
 23. Make simple bracket by bending and twisting nonferrous metal. Drill small holes (2mm) Drill holes on sheet metal, bend sheet round bracket.
 24. Form internal threads with taps to standard size (through holes and blind holes); prepare studs and bolt.
 25. Form external threads with dies to standard size. Prepare nuts and match with bolts.
 26. Countersink, counterbore, split fit (three piece fitting).
 27. File and fit combined radius and angular surface (accuracy 0.5mm) angular and radius fit. locate accurate hole. Make accurate hole for stud fit.
 28. Make assembly for dovetail sliding fits using lower pins and screw (0.04mm) Cutting threads using dies.
 29. Make sliding fits assembly with parallel and angular mating surface. (0.04mm)
 30. Make riveted joints (lap and butt joints).
 31. Drill on cylindrical surface.
 32. Make simple dowel pins-fitting dowel pins and tap screw assembly.
 33. Assembly sliding for using keys and dowel pin and screw ± 0.02 mm plain surfaces.
 34. Testing of sliding fitting job, scrap on two flat surfaces- and curved surfaces.
 35. File & fit angular mating surface plain within an accuracy of $\pm \pm$ minutes angular fitting.
 36. Drill through and blind holes at an angle-drill blind holes 'Y' fitting.
 37. Dovetailed fitting, radius fitting.
 38. Precision drilling, and tapping.
 39. File and fit combined fit with straight, angular surface ± 0.05 mm, hexagonal fitting.
 40. Drill small dia holes to accuracy-correct location for fitting. Make male and female fitting parts-drill holes.
 41. Make snap gauge ± 0.02 mm
 42. Make a Gap gauge ± 0.02 mm
 43. Practice in dovetail fitting assembly and dowel pins and cap screws assembly.
 44. Preparation of drill gauges.

45. Marking out as per blue print drilling, straight and curve filing. Threading with die, cutting internal threads with taps, making an adjustable spanner
46. Cutting of pipe ,fitting of pipes as per sketch. Conditions used for pipe work to be followed.
47. Drilling for riveting. Riveting with as many types of rivet as available -use of counters sunk head rivets
48. -do-
49. Grinding - surface &circular.
50. Revision
51. Revision
52. Test.

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SYLLABUS FOR : BENCH FITTER

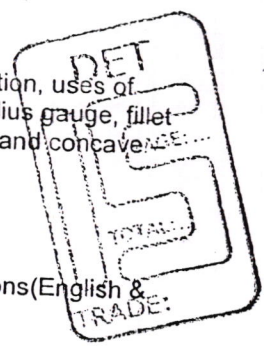
WEEKWISE THEORY SYLLABUS



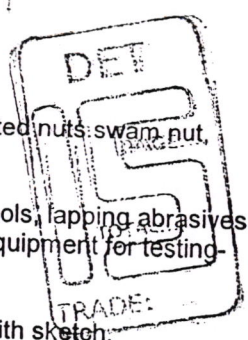
WEEK NO:

SYLLABUS

1. Importance of safety and general precautions observed in the Institute and in the section. Importance of the trade development of Industrial economy of the country. What is the related instructions subjects to be taught achievement to made. Recreational, medical facilities and other extra curricular activities of the Institute. (All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute System including stores procedures.
2. Safety accident preventions linear measurement its units dividers, calipers, hermaphrodite, centre punch, dot punch, their descriptions and uses of different types of hammers, Descriptions, uses and care of V Blocks, marking off table.
3. Bench vice constructions, types, uses care & maintenance, vice clamps, hacksaw frames and blades specification description, types and their uses, method of using hacksaws.
4. Files specifications, descriptions, material grades, cuts file elements uses, measuring standards (English Metric Units) angular measurements subdivisions, try square, ordinary depth gauge, protector descriptions, use and care.
5. Marking off and layout tools, divider, scribing block, odd leg calipers, punches descriptions classifications material care & maintenance.
6. Caliper types material constructional details, uses care & maintenance of cold chisels, materials, types, cutting angles.
7. Marking media marking blue prussian blue, red lead, chalk and their special application description. Use, care and maintenance of scribing block.
8. Surface plate and auxiliary marking equipment, V block, description types and uses, workshop surface plate their uses accuracy, care and maintenance.
9. Types of files convexing taper, needle care and maintenance of files, various types of keys, allowable clearances & tapers; types, uses of key pullers.
10. Physical properties of engineering metal: colour, weight, Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, elasticity.
11. Physical properties of engineering metal: colour, weight, Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, elasticity.
12. Drill process: common type (bench type, pillar type, radial type), gang and multiple drilling machine.
13. Vernier calipers, principle, constructions, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, Dial Vernier Caliper.
14. Micrometer outside and inside-principle constructional features, parts graduation reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care.
15. Drill material, types, (taper shank, straight shank) parts and sizes. Drill angle- cutting angle for different materials, cutting speed feed. R.P.M for different materials.
16. Drill troubles : causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: fractions, metric, letters and numbers, grinding of drill.

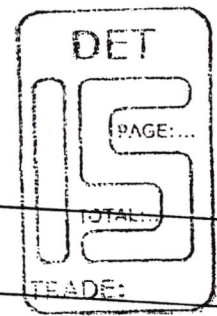


17. Grinding wheel : Abrasive , grade, structure, bond, specification, uses of mounting and dressing - Bench grinder parts and use of radius gauge, fillet gauge, material, construction, different dimensions, convex and concave uses, care and maintenance.
18. Radius gauge, feeler gauge, and their uses.
19. Vernier height gauge - material construction, parts, graduations(English & Metric) uses, care and maintenance
20. Screw threads: its terminology, parts, types, and their uses. Screw pitch gauge: material, parts and uses, taps, Method of using and calculating tap hole sizes.
21. Tap wrench-material parts, types (solid & adjustable types) and their uses removal of broken tap, studs(tap stud extractor).
22. Dies: material, parts, types, method of using dies. Die stock: material, parts and uses.
23. Counter sunk, counter bore and spot facing-tools and nomenclature, Reamer material, types (Hand and machine reamer) kinds, parts and their uses, determining hole size(or reaming), Reaming procedure.
24. Scrapers and their types, methods of scraping.
25. Vernier micrometer, material, parts graduation, use, care and maintenance.
26. Screw thread micrometer: construction, graduation and use.
27. Keys and keyways. Types and their uses construction (shape).
28. Spring - material types and uses.
29. Boits and Nuts: Material type (Hexagonal and square head) and their uses. Washers: Material, types (spring, tab, plain washer and fiber washer).
30. Dowel pins: material construction types accuracy and uses.
31. Screw: material, different types (inch & metric), uses.
32. Special files: types and description.
33. System of drill size. Fractional size : number, letter and metric. Templates and gauges. Introduction, necessity types.
34. Gauge: Introduction, necessity types-description and uses of gauge -types (feeler screw, pitch, radius, wire gauge)-description and use.
35. Limit gauge, Snap gauge, plug gauge, description and use.
36. Slip gauge : Necessity of using classification accuracy, set of blocks (English & Metric) Details of slip gauge. Metric sets 46:103:112. Wrining and building up of slip gauge and care and maintenance. Application of slip gauge for measuring
37. Sine bar- Principle, application & Specification.



- 38. Locking device : Nuts types (lock nut - castle nut, slotted nuts, swam nut, grooved nut). Description and use.
- 39. Lapping : Application of lapping material for lapping tools, lapping abrasives charging of lapping tools. Surface finish importance equipment for testing-terms relation to surfaces finish.
- 40. Limits and Fits: Definition, types description of each with sketch.
- 41. Production of gauges, templates and jigs. the object of importance for preparing interchangeable components.
- 42. Drilling Jig-construction features, type and uses.
- 43. Fixtures-constructional features types and uses.
- 44. Pipes and pipe fitting commonly used pipes. pipe bending methods. Use of bending methods. use of bending fixture, pipe threads die and tap, pipe vices.
- 45. Standard pipe fitting. methods of fitting or replacing the above fitting-pairs and erection on rain water drainage pipes and house hold taps and pipe work. Use of tools.
- 46. Tapers on keys and cotters permissible by various standards.
- 47. lubrication and lubricants. How lubrication is done. A good lubricant.- viscosity of the lubricant. Main property of lubricant.- How film of oil is formed in journal. Bearing methods of lubrications gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants : Soluble oil soaps, paraffin soda water -common lubricating oils and their commercial names - selection of lubricants.
- 48. Discuss the various rivets shape and form of heads riveting tools for drawing up the importance of correct head size. The spacing of rivets. Flash riveting, use of correct tools-compare hot and cold riveting.
- 49. Washers -type of washer sizes. The making of joints and fitting packing The use of lifting appliances, extractor presses and their use. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.
- 50. Revision.
- 51. Revision.
- 52. Test

SYLLABUS FOR BENCH FITTER
WEEKWISE ENGINEERING DRAWING SYLLABUS



WEEK NO:	SYLLABUS
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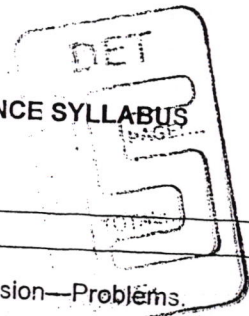
1. Introduction.
2. Use of drawing instrument.
3. Lettering numeric and alphabets. Vertical type.
4. Lettering number and alphabets inclined type.
5. Ex. In type of liner and application.
6. -do-
7. Ex. In conventional representations of materials.
8. -do-
9. -do-
10. Ex. In machining symbols and surface finish.
11. -do-
12. Drawing of plane fig - Triangle.
13. Drawing of plane fig - Quadrilaterals.
14. Drawing of plane fig - Polygons
15. Drawing of plane fig - Circles.
16. Methods of Dimensioning.
17. -do-
18. Simple Isometric Projection :- Cube, Rectangle circle, Cylinder and Cone.
19. -do-
20. -do-
21. -do-
22. Explanation of orthographic projection III rd Angle method, with example.
23. -do-
24. -do-

25. Explanation of orthographic projection I st Angle Method with example.
26. -do-
27. -do-
28. Simple Isometric Projection to orthographic projection like Hexagonal bar, square bar, circular bar and hollow bar.
29. -do-
30. -do-
31. -do-
32. Orthographic projection from different types of casting blocks.
33. -do-
34. -do-
35. -do-
36. -do-
37. Reading of simple Blue print.
38. -do-
39. -do-
40. -do-
41. Free hand sketching of Trade related Tools :- Hammers, Screw driver, Drills, Reamers, Files, Chisels, & Try Square.
42. -do-
43. -do-
44. -do-
45. Free hand sketching of measuring instruments :- Vernier caliper, Micrometer, and Gauges.
46. -do-
47. -do-
48. Free hand sketching of screw threads, Bolt and nuts, and Rivet & Riveted joint.
49. -do-
50. -do-
51. REVISION
52. TEST



SYLLABUS FOR BENCH FITTER

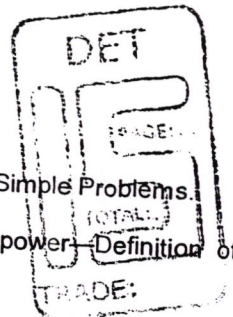
WEEKWISE WORKSHOP CALCULATION AND SCIENCE SYLLABUS



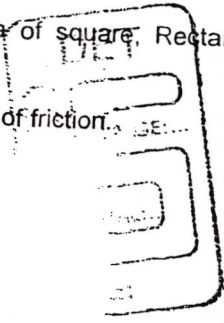
WEEK NO: _____ **SYLLABUS** _____

1. Fraction—Addition, Subtraction, Multiplication and Division—Problems.
2. Fraction—Addition, Subtraction, Multiplication and Division—Problems.
3. Decimal—Addition, Subtraction, Multiplication and Division—Problems.
4. Fraction and Decimals Conversion—Fraction to Decimal and vice-versa.
5. Simplification and shop problems in fraction.
6. Simplification and shop problems in fraction.
7. Physical properties and mechanical properties of metals.
8. Properties and uses of cast iron, wrought iron, plain carbon steels and alloy steels.
9. Properties and uses of cast iron, wrought iron, plain carbon steels and alloy steels.
10. Properties and uses of Copper, Zinc, Lead, Tin and Aluminium
11. Properties and uses of Brass, Bronze, Bearing Metal, Solder, Rubber and Timber.
12. Properties and uses of Brass, Bronze, Bearing Metal, Solder, Rubber and Timber.
13. System of units—British and Metric and S.I. Units for Length, Mass, temp, time.
14. System of units—British and Metric and S.I. Units for Length, Mass, temp, time.
15. Conversions between British and Metric Systems.
16. Conversions between British and Metric Systems.
17. The Square root—The Square and Square root of a Whole Number and Decimal.
18. Percentage—Changing Percent to Decimal and Fraction and vice versa—Problems on Percentages related to the Trade.
19. Percentage—Changing Percent to Decimal and Fraction and vice versa—Problems on Percentages related to the Trade.
20. Definition of Speed, Velocity, Acceleration, Mass, Weight and difference between Mass and Weight.
21. Definition of Speed, Velocity, Acceleration, Mass, Weight and difference between Mass and Weight.
22. Newton's Laws of Motion—Definitions of Force, inertia,
23. Ratio—Simple Problems in Ratios.

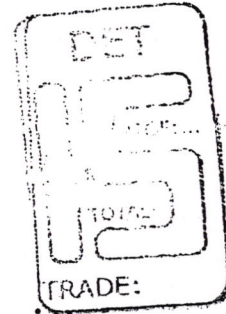
24. Ratio—Simple Problems in Ratios.
25. Proportion—Direct and Inverse Proportion—Shop Problems.
26. Proportion—Direct and Inverse Proportion—Shop Problems.
27. Work—Units of work in M.K.S. system and S.I. Unit of Work—Simple Problems.
28. Power—Practical Unit of Power such as Watt and horse power—Definition of I.H.P., B.H.P., and efficiency.
29. Power—Practical Unit of Power such as Watt and horse power—Definition of I.H.P., B.H.P., and efficiency.
30. Definition of Energy, Potential Energy, Kinetic Energy, Law of Conservation of Energy—S.I. Unit of Energy—simple Problems in P.E., and K.E.
31. Definition of Energy, Potential Energy, Kinetic Energy, Law of Conservation of Energy—S.I. Unit of Energy—simple Problems in P.E., and K.E.
32. Definition of Mechanical advantage, Velocity ratio and efficiency of simple machines.
33. Lever—Types of Levers with their examples.
34. Simple problems in levers.
35. Simple problems in levers.
36. Mensuration—Areas—Square, Rectangle, Equilateral Triangle, Isosceles Triangle, Right Angled Triangle, Scalene Triangle—Problems.
37. Mensuration—Areas—Square, Rectangle, Equilateral Triangle, Isosceles Triangle, Right Angled Triangle, Scalene Triangle—Problems.
38. Mensuration—Areas—Square, Rectangle, Equilateral Triangle, Isosceles Triangle, Right Angled Triangle, Scalene Triangle—Problems.
39. Areas—Hexagon, Circle, Circular Ring, Sector, Ellipse—Problems.
40. Areas—Hexagon, Circle, Circular Ring, Sector, Ellipse—Problems.
41. Mensuration—Volume and Weight of simple solid bodies such as cube, square prism, Rectangular Prism, Hexagonal Prism, Triangular Prism, Cone, Cylinder, Hollow Cylinder, Spheres - Shop Problems.
42. Mensuration—Volume and Weight of simple solid bodies such as cube, square prism, Rectangular Prism, Hexagonal Prism, Triangular Prism, Cone, Cylinder, Hollow Cylinder, Spheres - Shop Problems.
43. Mensuration—Volume and Weight of simple solid bodies such as cube, square prism, Rectangular Prism, Hexagonal Prism, Triangular Prism, Cone, Cylinder, Hollow Cylinder, Spheres - Shop Problems.
44. Finding the capacity in Litres of Square, Rectangle, Hexagon, Cone and Cylinder shaped vessels.
45. Finding the capacity in Litres of Square, Rectangle, Hexagon, Cone and Cylinder shaped vessels.



- 46. Finding the Lateral surface area and Total surface area of square, Rectangle, Hexagon, Cone and Cylinder shaped solids and vessels.
- 47. Finding the Lateral surface area and Total surface area of square, Rectangle, Hexagon, Cone and Cylinder shaped solids and vessels.
- 48. Friction – Laws of friction – Advantages and disadvantages of friction.
- 49. REVISION
- 50. TEST
- 51. REVISION
- 52. TEST



Achievements:



The trainee should be able to

- 1. Use fitters' hand tools.**
- 2. Mark according to simple blue print**
- 3. Do filing and Hacksawing.**
- 4. Drill holes**
- 5. Use precision measuring instruments**
- 6. Use tap and Dies**

INDUSTRIAL SCHOOLS

TRADE SYLLABUS – REVISED

Name of the Trade : **BENCH FITTER**

SPACE REQUIRED:

(1) Workshop/Lab : 450 sq. ft.

(2) Class Room : 200 sq. ft.

Trade Practical : No change

Trade Theory : No change

Engineering Drawing : No change

Workshop calculation and science

<u>WEEK NO :</u>	<u>REVISED SYLLABUS</u>
1-4	Fraction – Addition, Subtraction, Multiplication and Division – Problem.
5 & 6	Decimal - Addition, Subtraction, Multiplication and Division – Problem.
7 & 8	Fraction – and decimal Conversion – Fraction to Decimal and Vice versa.
9 & 10	Simplification and shop problem in fraction
11-14	Physical properties and mechanical properties of metals.
15- 17	System of Units-British and Metric and S.I.Units for Length, Mass, Temp, time.
18&19	Conversions between British and Metric Systems.
20&21	The square root – the Square and Square root of a whole number and Decimal
22-24	Percentage-Changing percent to Decimal and fraction and Vice versa— problem on Percentages related to the Trade.
25-27	Ratio—Simple Problems in Ratios.
28-30	Proportion—Direct and Inverse Proportion –Shop Problems.
31 & 32	Work-unit of work in M.K.S. system and S.I. unit of work- Simple problems
33-36	Menstruation- Areas- square, Rectangle, Equilateral Triangle, Isosceles Triangle, Right Angled Triangle, Scalene Triangle- Problems

<u>WEEK NO :</u>	<u>REVISED SYLLABUS</u>
37&38	Areas -Hexagon, Circle, Circular Ring -problems.
39-42	Menstruation—volume and weight of simple solid bodies such as cube, square prism, rectangular Prism, Hexagonal Prism, Triangular Prism, Cone, Cylinder, Hollow Cylinder, Spheres-Shop Problems.
43-45	Finding the capacity in Litres of Square, Rectangle, Hexagon, cone and cylinder shaped vessels.
46-48.	Simple simultaneous equation
49&50	Revision
51	Test
52	Common Examination

**LIST OF TOOLS AND EQUIPMENT FOR THE
TRADE OF BENCH FITTER**

(For a Batch of 20 trainees)

<u>Sl.No.</u> (1)	<u>Name of the Tools & Equipment</u> (2)	<u>Revised Number</u> (3)
1.	Rule Steel 15cm with metric graduations	10
2.	Try Square 10cm blade	10
3.	Out Side Caliper 15cm (Spring)	5
4.	Inside Caliper 15cm (Spring)	5
5.	Jenny Caliper 15cm	5
6.	Divider 15cm (Spring)	5
7.	Scriber 15cm	5
8.	Centre Punch 10cm	5
9.	Screw driver 15cm	5
10.	Cold Chisel (Flat 10mm)	5
11.	Ball Pein Hammer 0.45Kg. with handle	5
12.	Ball Pein Hammer 0.22Kg. with handle	5
13.	Flat file 25cm. (Second Cut)	5
14.	Flat file 25cm. (Smooth)	5
15.	Flat file 25cm. (Bastard)	10

<u>Sl.No.</u> (1)	<u>Name of the Tools & Equipment</u> (2)	<u>Revised Number</u> (3)
16.	Half Round File (Second Cut) 15cm	5
17.	Round File (Second Cut) 15cm	5
18.	Triangular File (Second Cut) 15cm	5
19.	Safe Edge File (Second Cut) 15cm	5
20.	Hacksaw Frame (Adjustable) 20-30cm	5
21.	Safety goggles	5
22.	Dot punch	5

General Tools / Instruments

23.	Rule steel 30 cm to read metric	2
24	Surface Plate small Size	1
25	Marking table 91x91x122cm	1
26	Vee Block 7cm with clamps	1
27	Angle Plate small	1
28	Number Punch 3mm set	1
29	Twist Drill S/S 3 to 9 mm by 0.5mm	1 each
30	Taps and dies	1set
31	Square file 15cm second cut	2
32	Can Oil (250ml)	1
33	Adjustable Spanner 10 cm	1
34	Flat Scraper 15cm	1
35	Triangular Scraper 15cm	1
36	Half Round Scrapper 15cms	1
37	Micrometer 0-25 (Outside)	1
38	Vernier Caliper 20cm	1
39	Vernier bevel protractor	1
40	Pipe wrench 30cm	1
41	Pipe vice No.4	1
42	Machine Vice 15cm	1
43	Vice bench Jaw small size	20
44	Work Bench	3
45	Almirah	1

<u>Sl.No.</u> (1)	<u>Name of the Tools & Equipment</u> (2)	<u>Revised Number</u> (3)
46	Black board	1
47	Fire extinguisher	1
48	Fire buckets	2
<u>General Machinery</u>		
1	Anvil 25kg. With Stand Minimum Weight	1
2	Drilling machine (Bench-Sensitive 0-12mm capacity - 1/2 HP motorized with chuck and key)	1
3	Bench Grinding machine (General Purpose) (with rough and smooth wheels)	1