

CARPENTRY WORKSHOP

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Part No.	Date	Description
P-1	PI-PO-21	measured stick
P-2	PI-PO-21	weight
P-3	PI-PO-21	sawnup for test
P-4	PI-PO-21	cutting tool
P-5	PI-PO-21	must be sharp
P-6	PI-PO-21	use two double
P-7	PI-PO-21	over for cutting
P-8	PI-PO-21	power for movement
P-9	PI-PO-21	reheat the blade
P-10	PI-PO-21	stop
P-11	PI-PO-21	power stop

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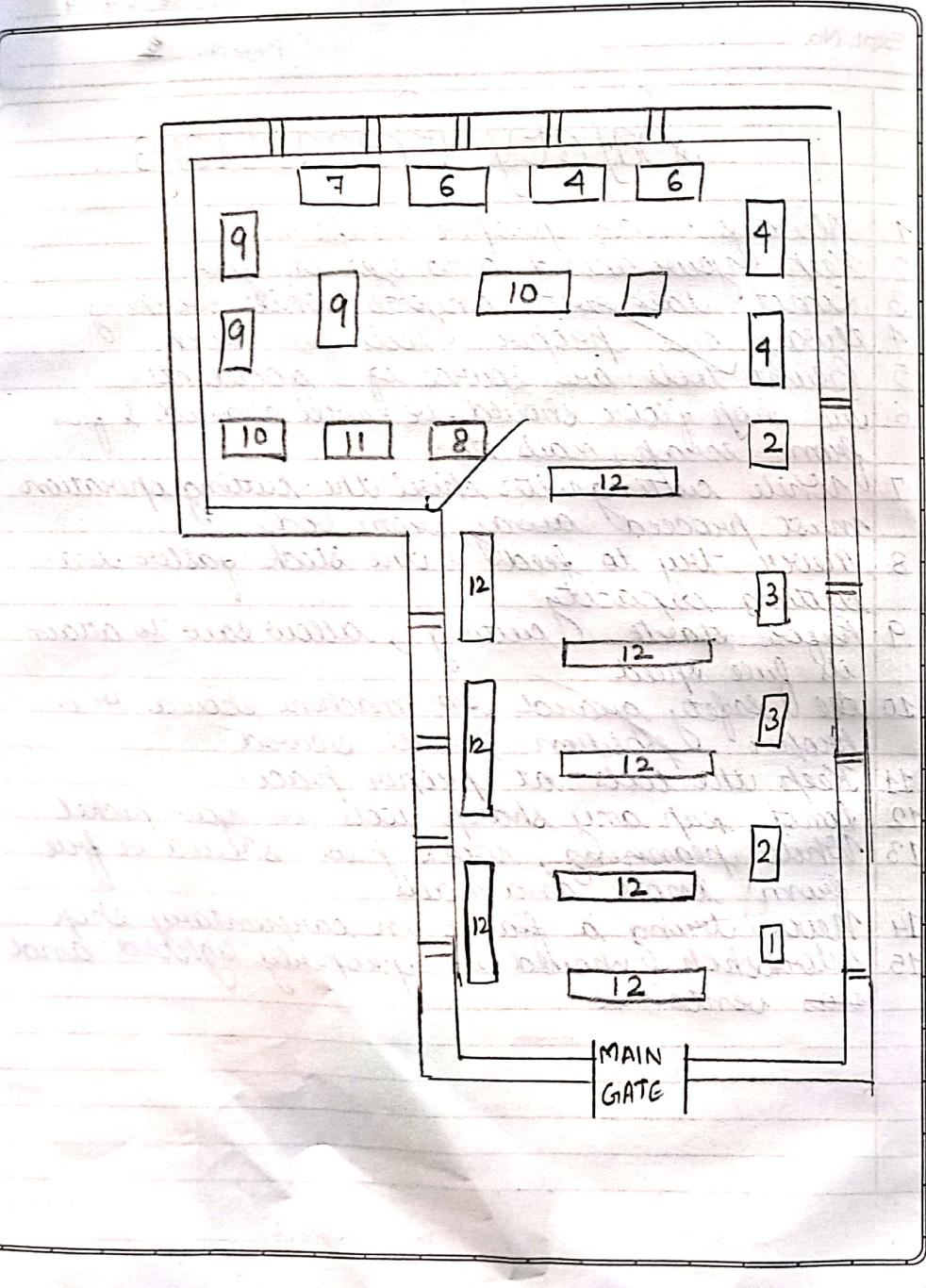
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Safety Precautions

- 1 Always wear proper uniform
- 2 Keep your mind and eyes on job
- 3 Do not talk with anyone while working
- 4 Always use proper tools for work
- 5 Blunt tools are source of accidents.
- 6 The shop floor should be well cleaned & free from scrap, nail etc.
- 7 While cutting with chisel the cutting operation must proceed away from body
- 8 Never try to feed the stock faster than cutting capacity.
- 9 Before starte cutting, allow saw to attain its full speed.
- 10 All safety guards on machine should be in proper position & well secured.
- 11 Keep the tools at proper place.
- 12 Do not keep any sharp tools in your pocket.
- 13 While sawing, work piece should be free from knots and nails.
- 14 Never bring a flame in carpentry shop
- 15 Workshop should be properly lighted and well ventilated

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Lists of Equipments

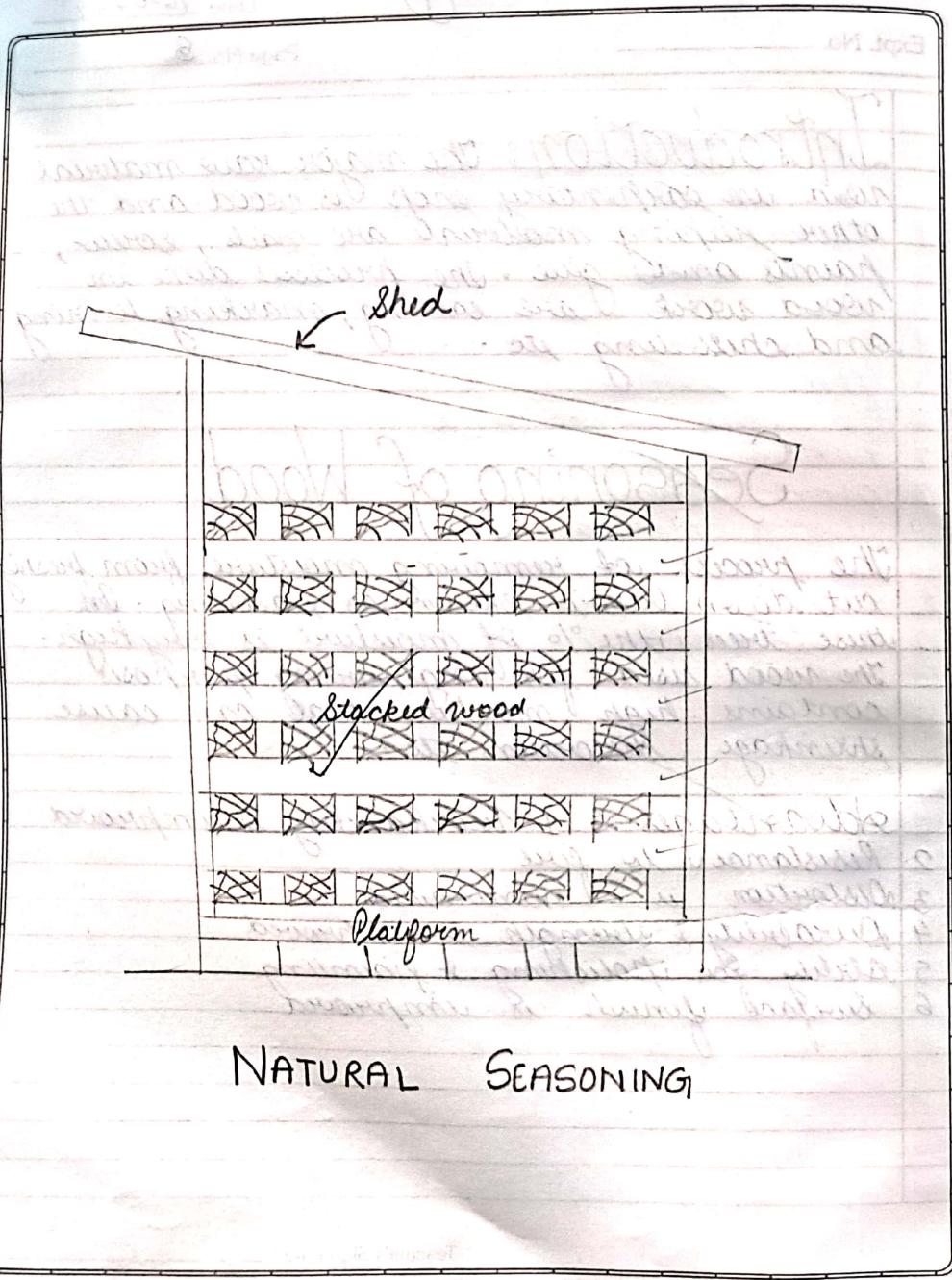
- 1 Jig saw
 - 2 Wood Turning Lathe.
 - 3 Drilling
 - 4 Grinder
 - 5 Chain mortising machine
 - 6 Universal wood working machine
 - 7 Thickness planer
 - 8 Circular saw
 - 9 Wooden Almirah
 - 10 Tool Boxes
 - 11 Rack for material
 - 12 Working Table
 - 13 Incharge Table

layout

- | | | |
|----|--------------------------------|---------------------|
| 1 | Jig saw | (19) Working Table |
| 2 | Wood turning lathe | (13) Incharge Table |
| 3 | Drilling | |
| 4 | Grunnder | |
| 5 | Chain mortising machine | |
| 6 | Universal wood working machine | |
| 7 | Thickness planer | |
| 8 | Circular saw | |
| 9 | Wooden Almirah for tools | |
| 10 | Tool Boxes | |
| 11 | Rack, for material store | |

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Introduction: The major raw material used in carpentry shop is wood and the other helping material are nails, screws, paints and glue. The processes done in wood work are sawing, marking, turning and chiselling etc.	
<h2>Seasoning of Wood</h2>	
<p>The process of removing moisture from freshly cut down trees is known as seasoning. In these trees the % of moisture is very high. The wood used for engineering purposes contains high moisture that can cause shrinkage, distortion etc.</p>	
<p>Advantages :</p> <ul style="list-style-type: none"> 1 Workability is improved 2 Resistance to fire 3 Distortion is minimised 4 Durability & strength is improved 5 Easier for polishing & painting 6 Surface finish is improved 	



(3)

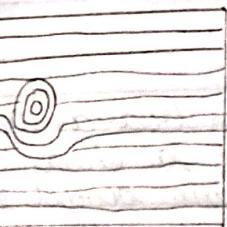
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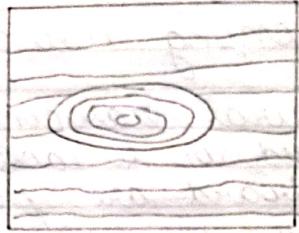
Seasoning Method:

- 1 **Natural seasoning:** In this boards are stacked one to each other in a shed. The board are protected from direct exposure of sun or rain. A platform is made about 50 cm from ground level & is properly leveled. Some items such as soil or sand is sprayed on this layer for preventing from exposures of moisture and shed is fabricated on this platform. Then the sleepers are stacked in shed, keeping a gap between the sleepers for free circulation of air. Due to this, the excess moisture gets evaporated very easily and sleeper becomes dry. By this method, wood is available at cheaper rate.
- 2 **Kilm seasoning:** In this method, the wooden pieces are kept on trolleys and then it is placed inside hot chamber of furnace known as kilm. In this way wooden pieces are kept in controlled atmosphere condition for 2 weeks. It is a quick drying method & the moisture is reduced to 10%. Since seasoning is done at lesser time through artificial means.

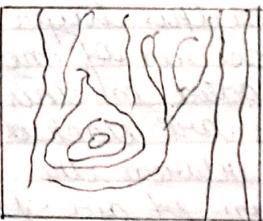
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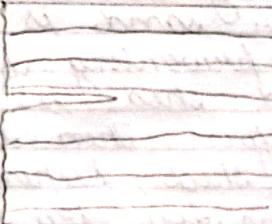
CIRCULAR KNOTS



OVAL KNOTS



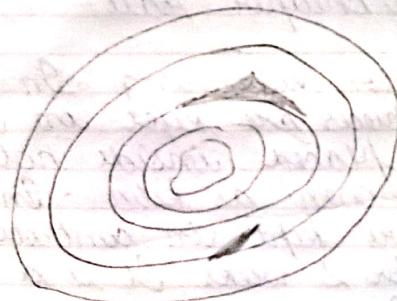
IRREGULAR KNOTS



LINE KNOT



HEART SHAKES



RING SHAKES

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3 Water seasoning : In water seasoning, the wooden pieces are immersed in flowing water for 1 month. The water removes excess sap in wood. Then wooden pieces are taken for natural seasoning. In this process the time taken is less and strength of wood increases.

4 Chemical seasoning : It is seasoning in which wooden pieces are exposed to chemicals.

Defects in Wood

1 Natural defects are defects in which are caused in tree due to abnormality in growth.

2 Defects due to seasoning operation

3 Defects due to termites or insects

Natural defects :

1 Knots : Knot is centre of irregular grown part of tree. The cells of tree are wrapping around it & the normal shape of internal structure is disturbed.

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There are 2 types of knots:

- 1 Live knots - these occur after felling of tree
- 2 Dead knots - these occur before felling of tree

These knots are classified acc. to their shape

- | | |
|------------------|--------------------|
| 1 Circular knot | 4 Fine knot |
| 2 Oval knot | 5 Symmetrical knot |
| 3 Irregular knot | 6 Group knot. |

2 Shakes: Shakes are produced by internal & external diseases of tree. When there is delay in cutting of tree even after complete maturity at that time bonding material like glams of tree evaporates

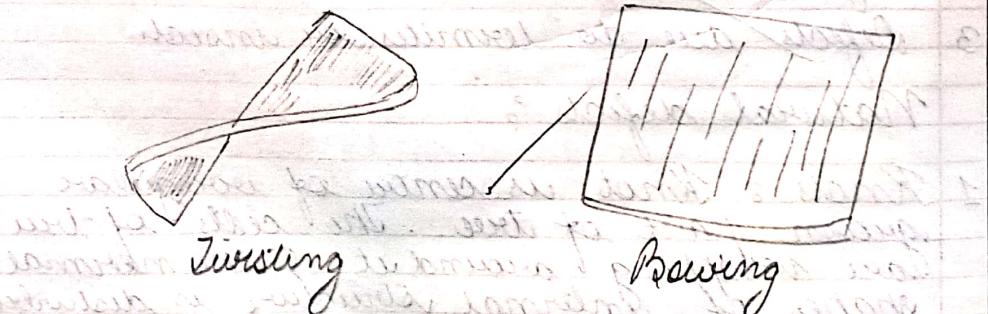
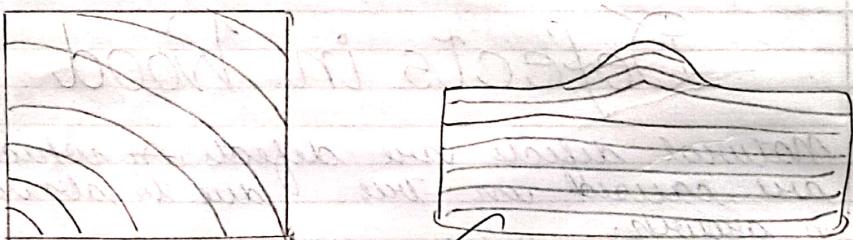
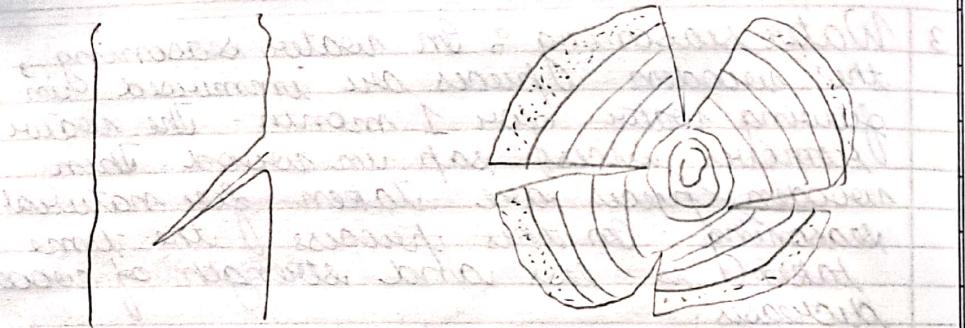
There are many types of shakes.

- | | |
|------------------|------------------------|
| 1 Heart shakes | 2 Ring shakes |
| 3 Twisted shakes | 4 Peripherical shakes. |

3 Twisted grains: When trees are affected by frost grains their grains become twisted. The grains of wood are not straight but are at an inclination with respect to axis

4 Ring gall: It is uneven broken part of tree. It generally appears where branches

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are cut or irregularly broken.

5 Distortion : Due to uneven moisture inside wood, the shape of wood is distorted. It is caused by improper seasoning.

6 Surface hardening : As outer part of the wood dries faster than inner portion, stresses are developed on outer surface of wood.

Seasoning defects

1 Shakes : During cutting sometimes heavy impact places place between the fibers and ground results in crack inside the timber radially or during conversion.

2 Distortion : This defect occurs if moisture content in wood is lesser than lower permissible limits. In case seasoning is not proper.

3 Honey combing : Due to presence of hygroscopic substances in wood, the inner portion of wood dry faster than external portion.

Termites & insects defect

1 Dry rot : It is dark brown in colour.

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& breaks by application of slight pressure.

2 Wet rot : It is found in that portion of wood which is affected by fungi & it appears as brownish powder.

3 Termites : There are several insects that affect life of timber, for e.g. white termites make timber hollow from inside.

STRUCTURE OF WOOD

1 Pith : It is central part of tree. It directs the sap from roots to leaves.

2 Heart wood : The portion surrounded by pith is called heart wood. The % of moisture is less in it than central part.

3 Sap wood : The part of trunk between heart wood & cambium layer is sap wood. It is light in weight, softer & weaker part.

4 Cambium layer : The rings adjacent to bark are known as cambium layer.

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5 **Bark**: The outer surface of tree which act as a cover for inner portion.

6 **Medullary rays**: These are radial layer starting from pith up to cambium layer.

7 **Annual rings**: These are concentric layers of wood around pith.

Conversion of Wood

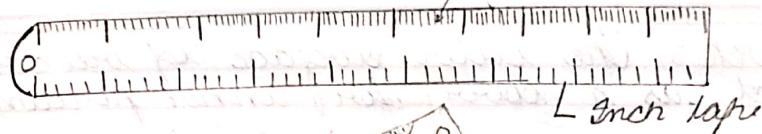
1 **Flat sawing**: In this method a no. of parallel saw cuts are made into wood. This method is cheapest method. But sawn sections are likely to warp fast as such as the timber is sawn by this method.

2 **Tangential sawing**: In this method the width of boards is kept tangential to annual rings.

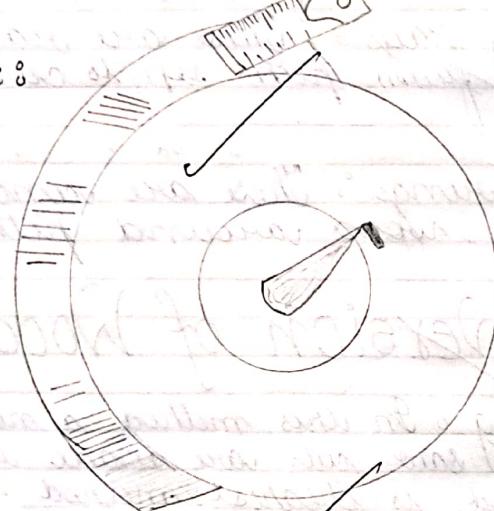
3 **Quarter sawing**: The logs are sawn in method so that width of sawn board goes along medullary rays.

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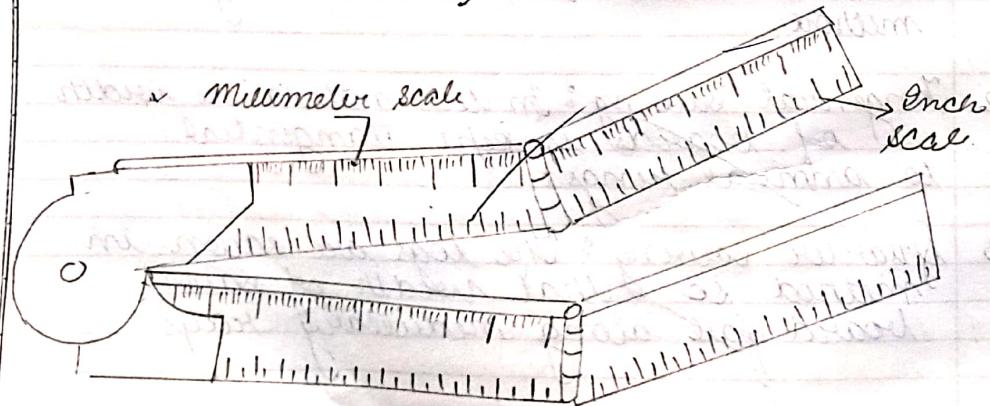
Steel Rule : Centimeter scale



Inch tape :



Tour fold box wood scale :



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Qualities of good Timber

- 1 It should be free from all types of defect.
- 2 It should have straight fibres.
- 3 It should have dark colour.
- 4 It should be durable and heavy.
- 5 It should be free from knots.
- 6 It should be free from knots decay.
- 7 It should be easy to work.
- 8 It should give sweet smell.
- 9 It should give clear sound by striking.
- 10 It should have regular annual rings.

Carpentry Tools

1 Measuring tools

1 Inch tape : It is made up of flexible thin steel strip. It is folded about a central pin with a handle.

2 Contraction Scale : It is also a rule type scale used for making pattern

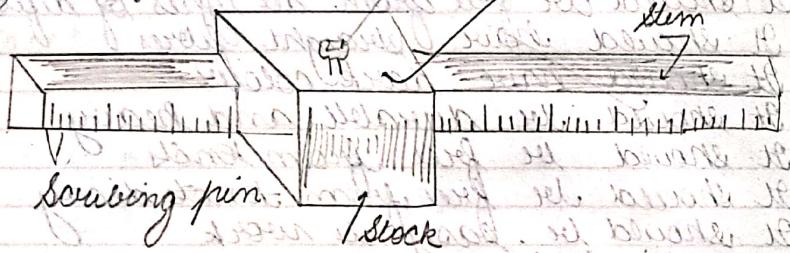
3 Steel Rule : It is made up of stainless steel & is marked with scale. In this scale also there is graduation in both inches and centimeters.

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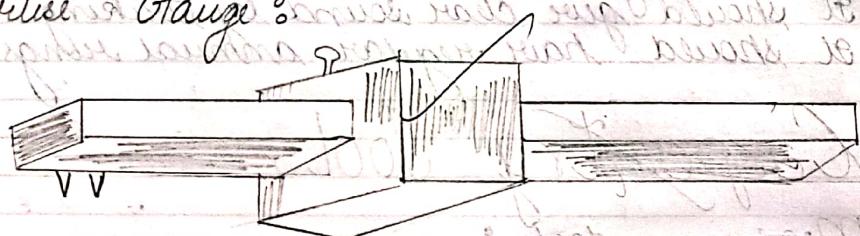
Scriber



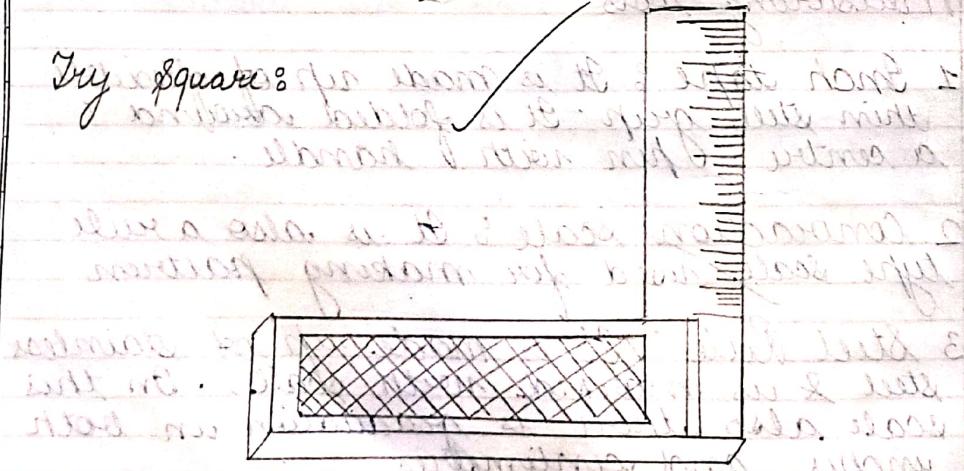
marking Gauge.



Mortise Gauge.



T try square:



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- 4 Four fold Box Wood rule. It is generally 2 ft long and is folded from 3 places. It is marked in inch & millimetre scale. The inches are further divided into 8 or 16 equal parts.

Marking Tools

1 Pencils Lead pencil is generally used for marking purposes.

2 Scriber: Scriber has sharp conical edge used to mark even hard surfaces. The front edge is hardened so as to resist wear & tear.

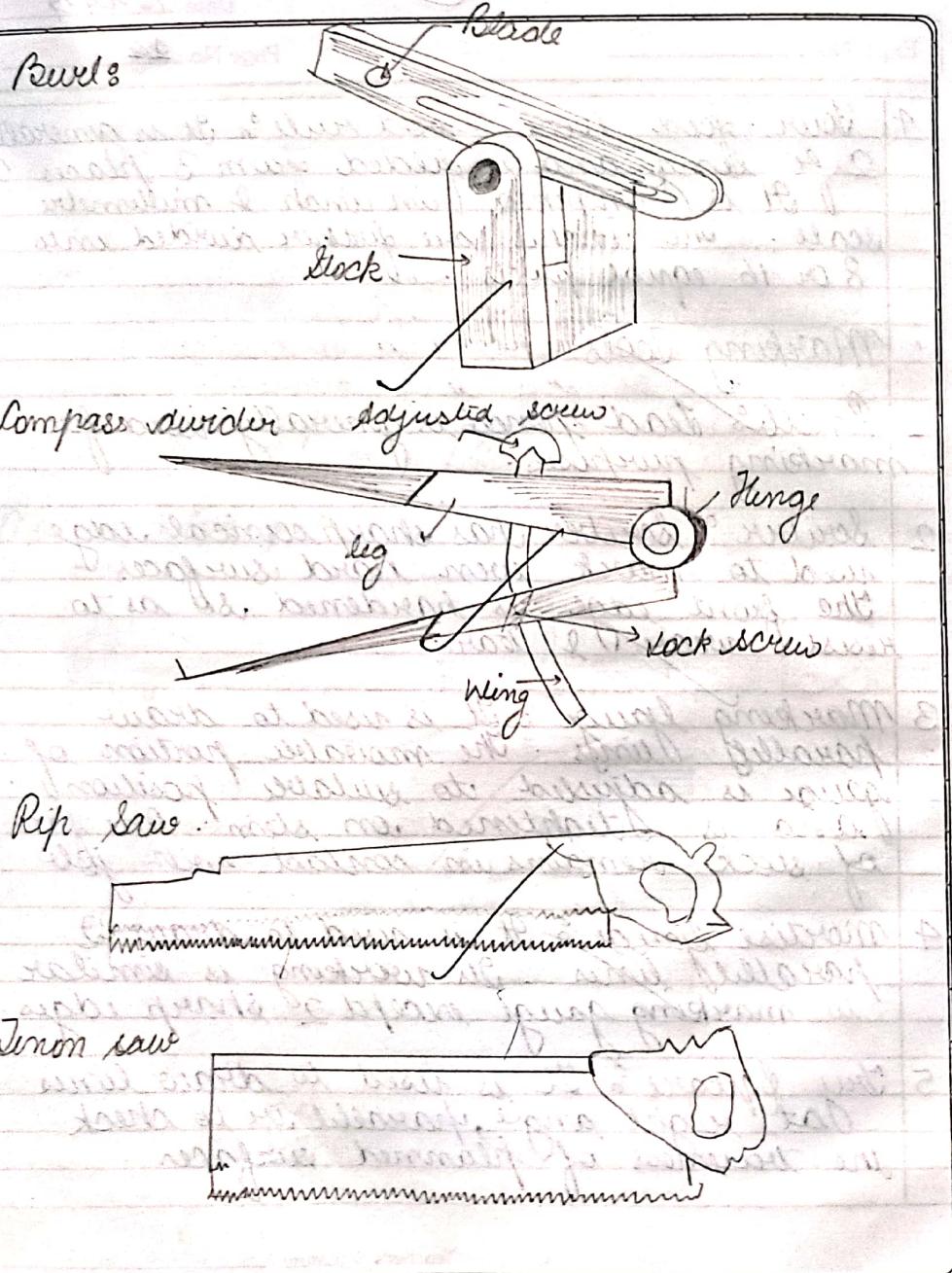
3 Marking Gauge: It is used to draw parallel lines. The movable portion of gauge is adjusted to suitable position and is tightened on stem. One face of stock remains in contact with job.

4 Mortise Gauge: It is used to draw 2 parallel lines. Its working is similar to marking gauge except 2 sharp edges.

5 Try Square: It is used to draw lines at right angle, parallel or to check the true ness of planned surfaces.

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6 **Bevel :** It consists of a wooden handle fitted with adjustable blade.

7 **Dividers / Compass :** It is used for dividing equal no. of parts & for drawing arcs and circles.

Cutting Tools :-

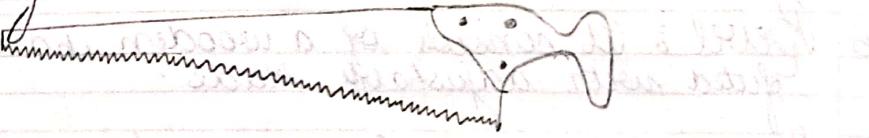
1 **Saw :** A saw is a multi tooth tool made up of thin sheets attached with a wooden handle. Its teeth are ground and sharpened to achieve smooth cutting.

(1) **Rip saw :** It is hand saw from 30cm to 15cm containing one to one and half teeth per cm and cutting of wood is done along grains.

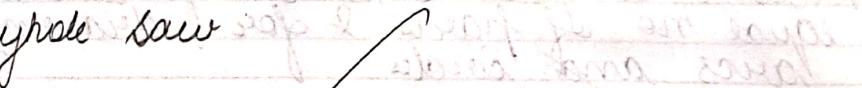
(2) **Tenon saw :** It derives its name from tenon form of joint. It is thin saw ranging from 20 cm to 40 cm in length supported by back of wrought iron or brass.

(3) **Coping saw :** It is used for cutting quick and sharp curves either internally or externally.

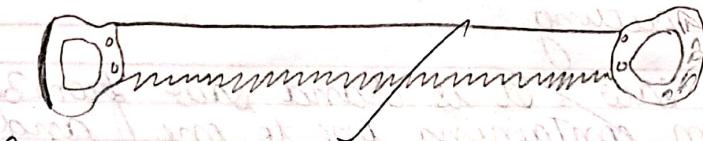
Loping Saw :



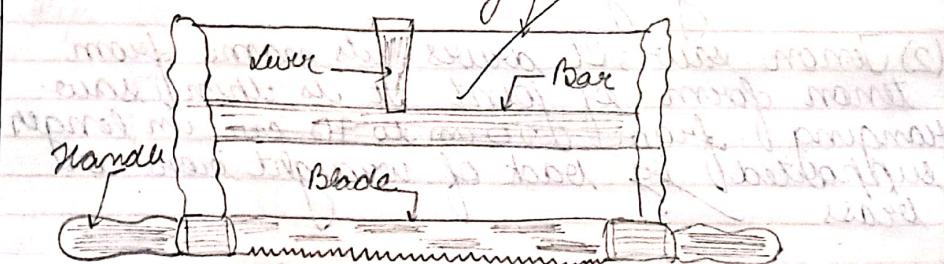
Keyhole saw



Cross cut saw :



Bow Saw :



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(4) Compass saw : It is short narrow saw, tapering towards the point, used for cutting sweeps & large interior curves by hand.

(5) Keyhole saw : It is used for cutting thick interior curves.

(6) Cross-cut saw : It is provided by with 2 handles, one at each end.

(7) Bow saw : It consists of wooden frame, a bar, a string, lever and 2 handles. It is used to produce curved surfaces.

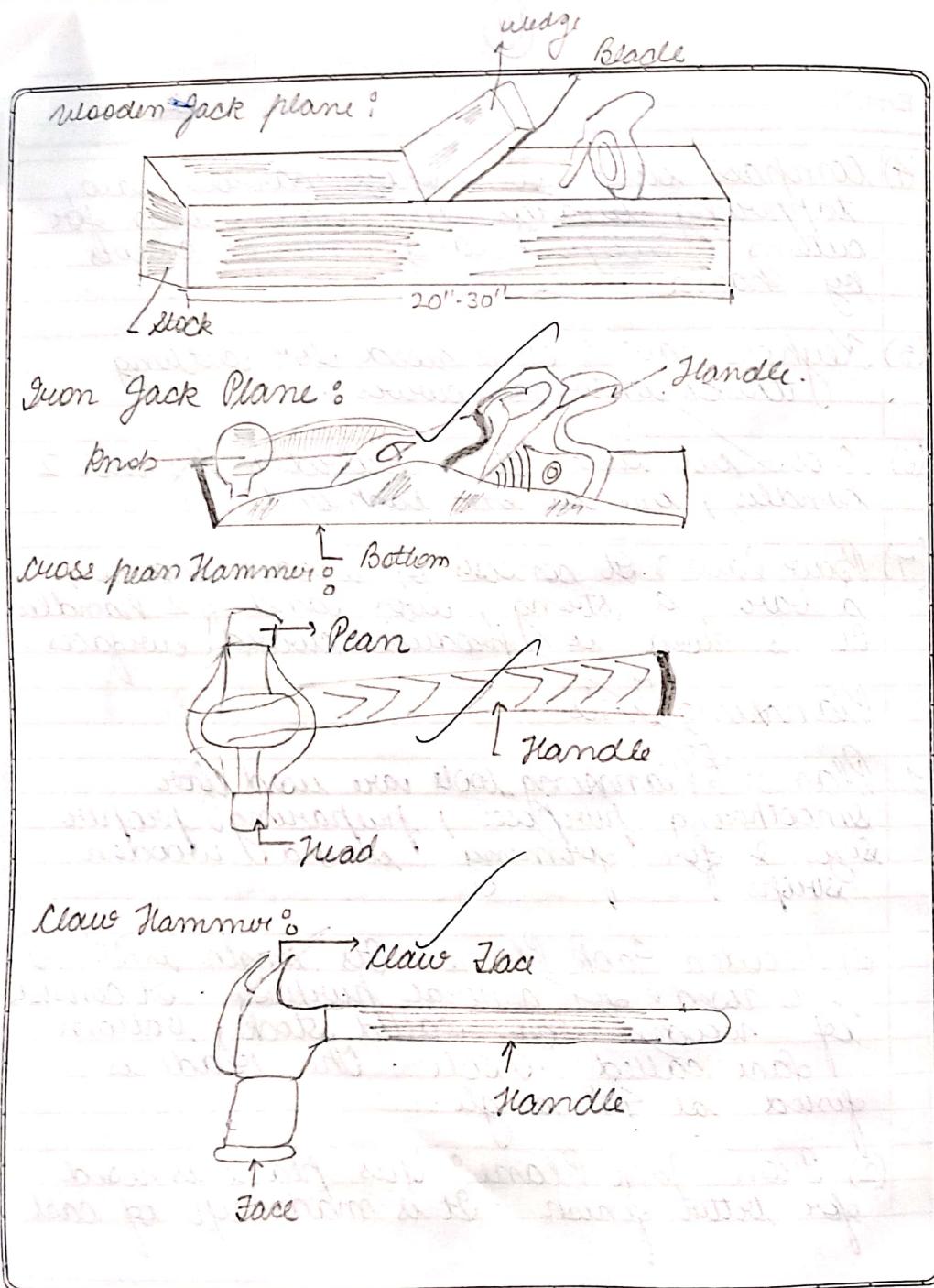
Planing Tools

1 Planes : Planing tools are used for smoothing purposes, preparing proper sizes & for forming curved wooden strips.

(1) Wooden Jack Plane : Its length is 20"-30" & is used for general purposes. It consists of wooden body called stock, bottom plate called sole. The blade is fixed at 45° angle.

(2) Iron Jack Plane : This plane is used for better finish. It is made up of cast

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iron with wooden handle at back & wooden & a wooden tie knob at front so that it can be held by both hands.

(3) **Trying Plane:** The length of this plane is 20"-30" & looks like Jack plane.

(4) **Rebate Plane:** This plane is used to prepare the edge of board, the cutting edge of blade can be adjusted.

(5) **Plough Plane:** It is used for making grooves at same time there is also another plane called hollow plane.

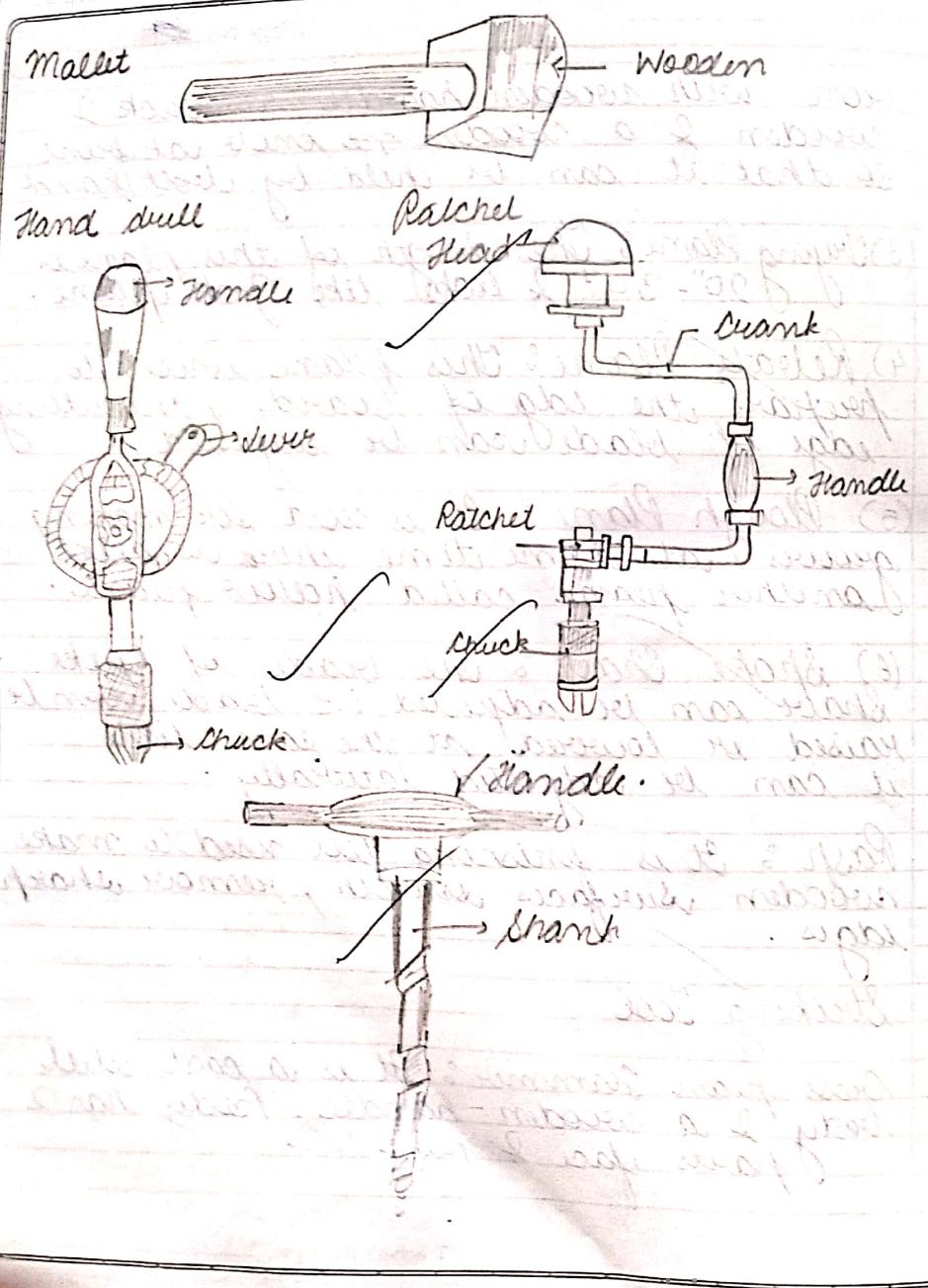
(6) **Spoke Shave:** The blade of spoke shave can be adjusted i.e. blade can be raised or lowered at the same time it can be adjusted laterally.

2 **Rasp:** It is finishing tool used to make wooden surfaces smooth, remove sharp edges.

Striking Tool

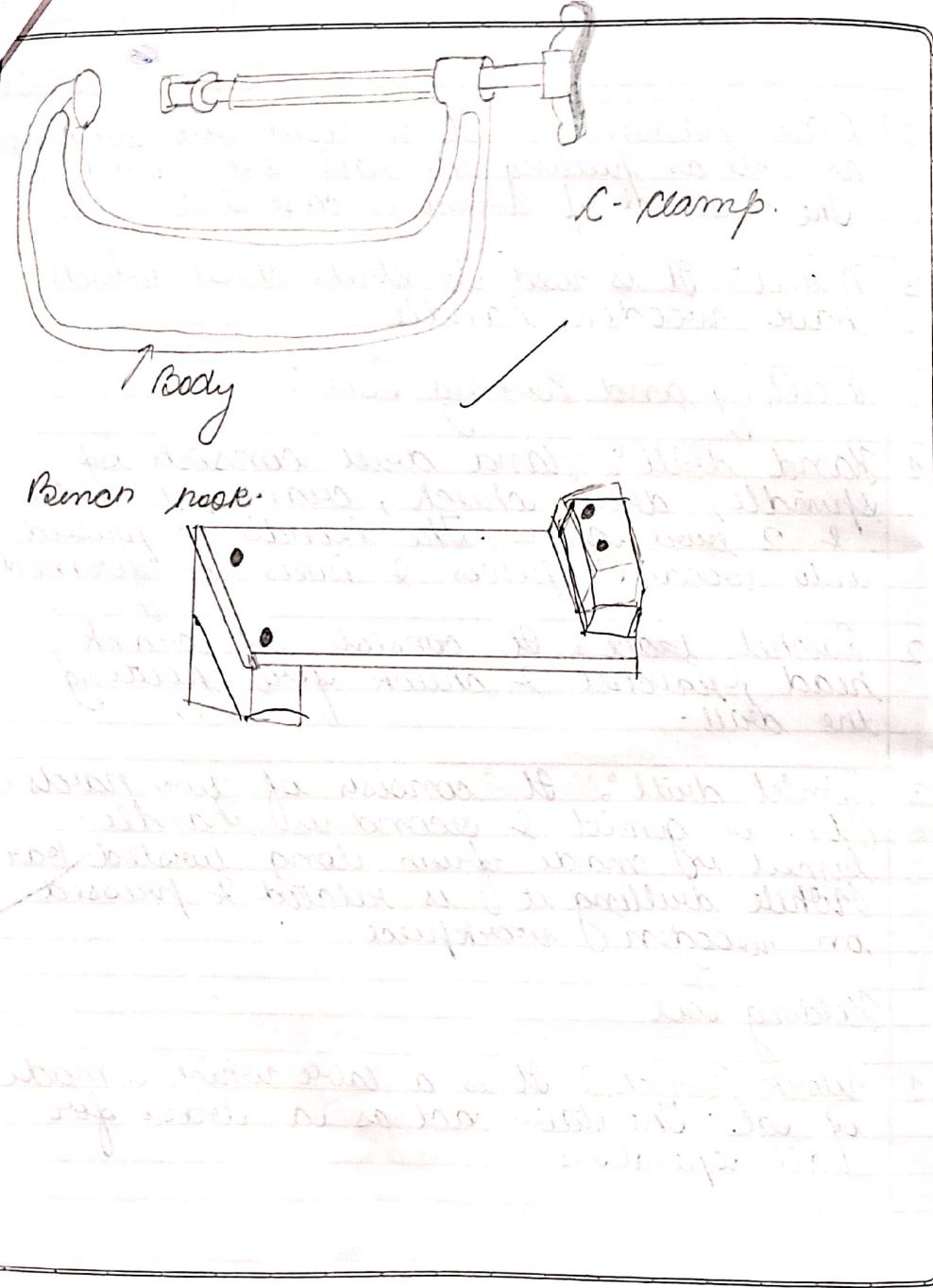
1 **Cross pean Hammer:** It is a cast steel body & a wooden handle. Body has 2 parts face & pean.

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- 2 **Claw Hammer** : It is used for striking as well as pulling the nails from wood. The material of wood is cast steel.
- 3 **Mallet** : It is used to strike chisel which have wooden handle.
- Drilling and Boaring Tool :**
- 1 **Hand drill** : Hand drill consists of spindle, drill, chuck, crank, handle & 2 gear gears. The handle is pressed into wooden pieces & hole is formed.
 - 2 **Ratchet brace** : It consists of crank, head, ratchet & chuck for holding the drill.
 - 3 **Gimlet drill** : It consists of two parts. One is gimlet & second is handle. Gimlet is made from long twisted bar. While drilling it is rotated & pressed on wooden workpiece.
- Holding Tool**
- 1 **Work Bench** : It is a table which is made of wood. The table acts as a base for all operations.
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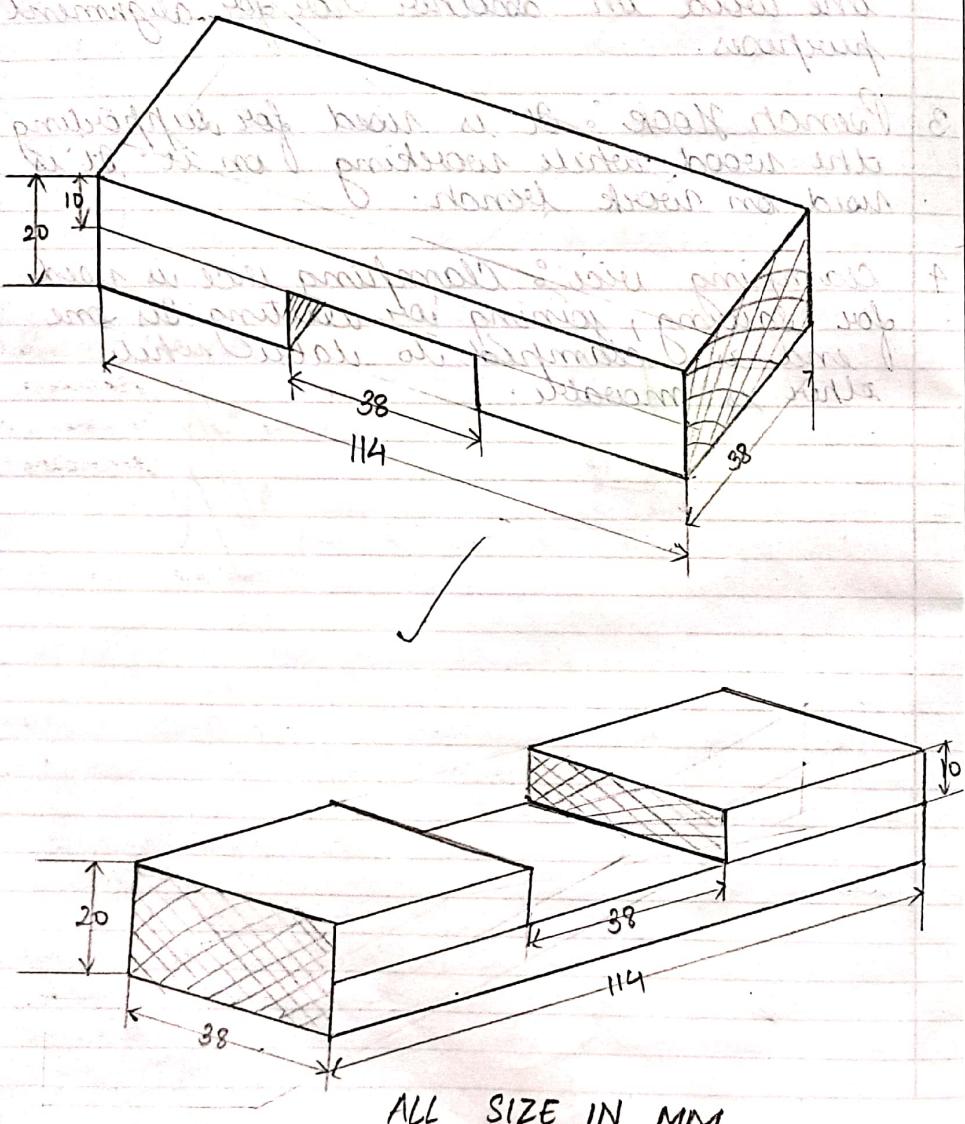
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2. **C-Clamp :** It generally is used to paste one wood on another for alignment purposes.
3. **Bench Hook :** It is used for supporting the wood while working on it. It is used on work bench.
4. **Clamping vice :** Clamping vice is used for sawing, joining or cutting. Its one end is clamped to table while other is movable.

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EX NO-1

HALF LAP JOINT



(17)

Date: 16-04-19

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Job - 1

Experiment : To prepare half lap joint

Materials: Jack Plane, Tenon saw, marking gauge, Steel foot rule, Scraper, try square, wooden mallet etc

Theory This helps in practice of former chisel, jack plane etc. It is used in door frames & racks.

Procedure : 1 The size of piece should be 950x40x22mm. Plane 40 mm side & check its straightness with try square & same with 22mm side.
2 Mark both sides 38 mm & 20mm & remove extra material by jack plane.
3 Cut piece into 2 parts as per drawing & mark 3 equal parts of 38 mm size.
4 Remove the material from central part of both regions & fine them at right angles.

Precautions : 1 Wooden piece should be free from defects
2 Floor of shop should be free from obstruction
3 Chisel should be used across grain.
4 During cutting operation by Tenon saw, the saw should be placed outside marking.

20/4/19

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BLACKSMITHY Workshop

M. J. S.

1

1

Blacksmithy (2)

Date

2

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Safety Precautions

1. Do not touch any metal part unless you know that its temperature is normal.
2. Heavy blows of workplace in the centre of anvil.
3. Never handle silky clothes in forging shop while working.
4. Never wear silky clothes in forging shop while working.
5. Defective equipment & tools should not be used for any work.
6. Always wear uniform in the workshop.
7. The fire should be lighted in the furnace very carefully.
8. There should be no leakage of fuel from pipes.
9. All exhaust gases & smoke should go chimney.
10. The metal piece should neither be over heated nor under heated.

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PHOTO-ESS

(3)

TOOL &
JOB RACE

OIL FURNANCE

O.M

TAP

A

O.C.E

A

S.B

A

A.P

H.F

A

SW

W.T

O.C.E

A

A

C.F

C.S

S.B

A

P.H

O.C.F

A

C.F

G.M

L.V

A

C.F

E

STAFF TABLE

HEAVY
DUTY
GLOVER

8

10

12

14

16

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Layout

F → Entrance

CF → Coal Furnance

A → Anvil

C.S → Coal store

S.W → Scrap Wood

C.S → Chop saw

W.T → Water Tank

S.B → Block

P.H → Power Hammer

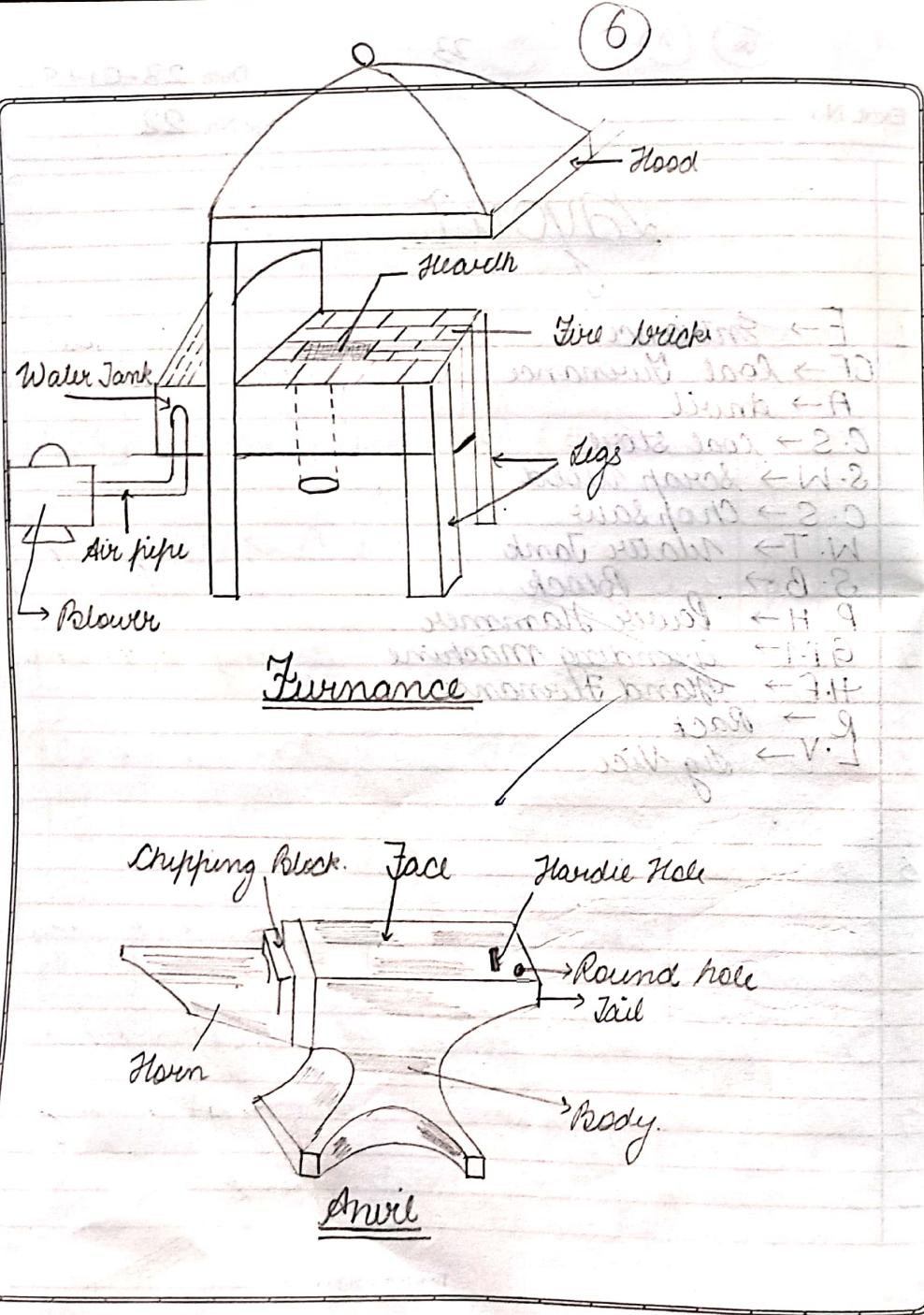
G.M → Grounding Machine

H.F → Hand Furnance

R → Rack

L.V → Dig Vice

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Introduction :- The process of giving a desired shape to a metal piece by heating and hammering is known as forging.

The metal piece is heated upto a desired temperature called forging temperature.

Forging Tools & Equipment :-

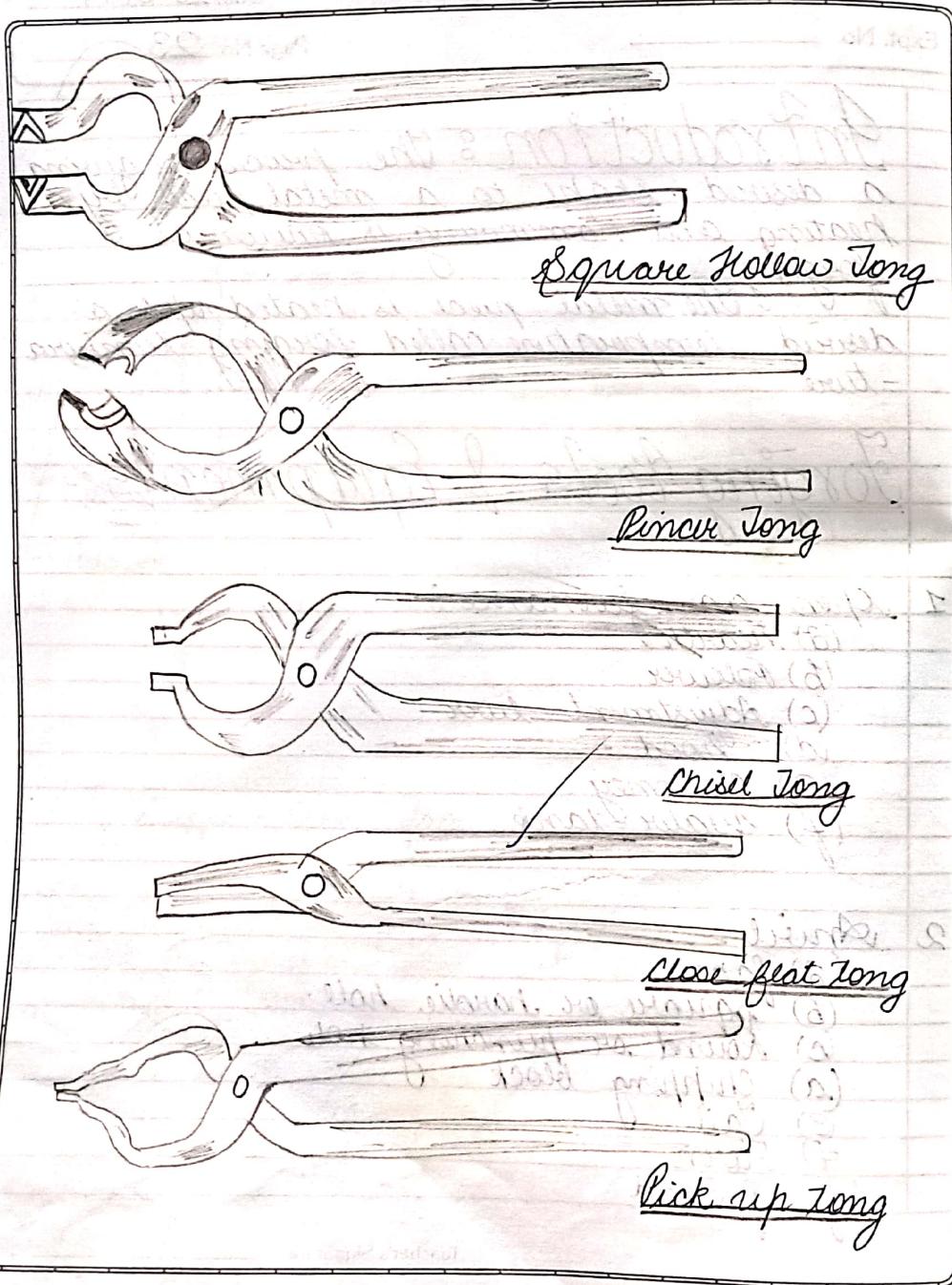
1. Open coal furnace :-

- (a) Hearth
- (b) Blower
- (c) Adjustment lever
- (d) Hood
- (e) Chimney
- (f) Water tank

2. Anvil

- (a) Face
- (b) Square or handle hole.
- (c) Round or punching hole.
- (d) Chipping block
- (e) Jail
- (f) Horn
- (g) of. Stand

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3 Types of materials :

- (a) Solid for eg coal, coke, charcoal
- (b) Liquid for eg oils
- (c) Gaseous for eg natural gas.

4 Types of hammer :

- (a) Cross peen hammer.
- (b) Straight peen sledge hammer
- (c) Power hammer.

5 Types of tong :

- (a) Round hollow tong
- (b) Square tong
- (c) Chisel tong
- (d) Flat Tong
- (e) Pincer tong
- (f) Pick up tong

6 Chisels :

- (a) Hot Chisel
- (b) Cold chisel
- (c) Hardie Set

7 Supporting Tools :

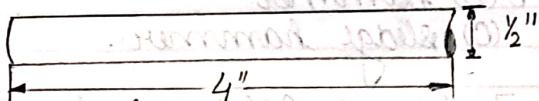
- (a) Anvil
- (b) Swayage Block

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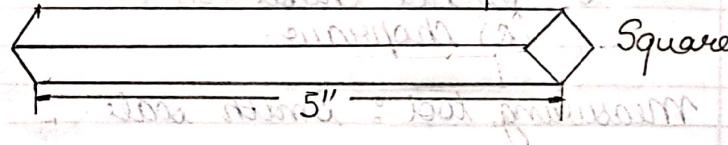
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Job No 1: To make a poker from M.S. Rod $1\frac{1}{2} \times 4"$

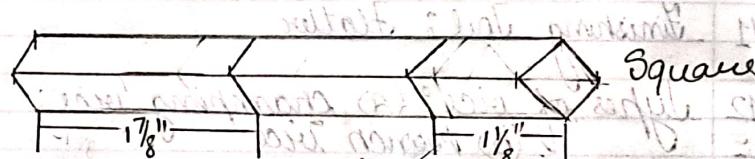
Step 1:



Step 2:



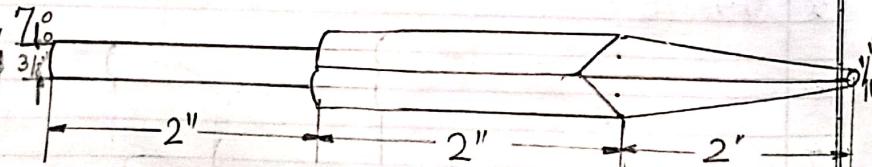
Step 3:



Step 4, 5:



Step 6, 7:



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Job 1: To make a poker from M.S. rod of $1\frac{1}{2} \times 4"$

Tools: Cutting Tools - Cold chisel
Holding Tools - Ring Tong & flat long
Supporting Tools - Anvil & Sledge Block
Finishing Tool - Flatter

Equipment: Open hearth furnace,
Blower, vessel tank,
Smith scale, Flatter, Forging temperature
 $(750^{\circ}\text{C}-1150^{\circ}\text{C})$

Procedure: 1 Take a bar of M.S. of size $1\frac{1}{2} \times 4"$ & cut it with help of cold chisel and wedge hammer.

2 Heat the job by holding it with ring tong in coal furnace to bright yellow colour and make it square having length of $4\frac{1}{4}"$ on anvil.

3 Heat the job in coal furnace to red hot colour and smooth it with flatter on anvil and make it $5"$.

4 Mark the job to measure the size i.e. $\frac{7}{16}"$ on one side & $1\frac{1}{8}"$ on other side.

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(14)

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- 5 Heat one end of job of size $1\frac{7}{8}''$ to bright colour & make it round $3\frac{1}{8}''$ dia on anvil by hand hammer. Rounding operation is to be hand hammer on corner of square and rotate job piece simultaneously.
- 6 Again heat round end of job to red hot colour and finish the round face by surge set & making of size of $2'' \times \frac{3}{8}$ dia.

Precations:
1) Heat should be light
2) Strike in proper way

- 1) Heat should be light
2) Hammering should not be done in lazy mood
3) Always hold the job with long.
4) Measurement must be accurate.

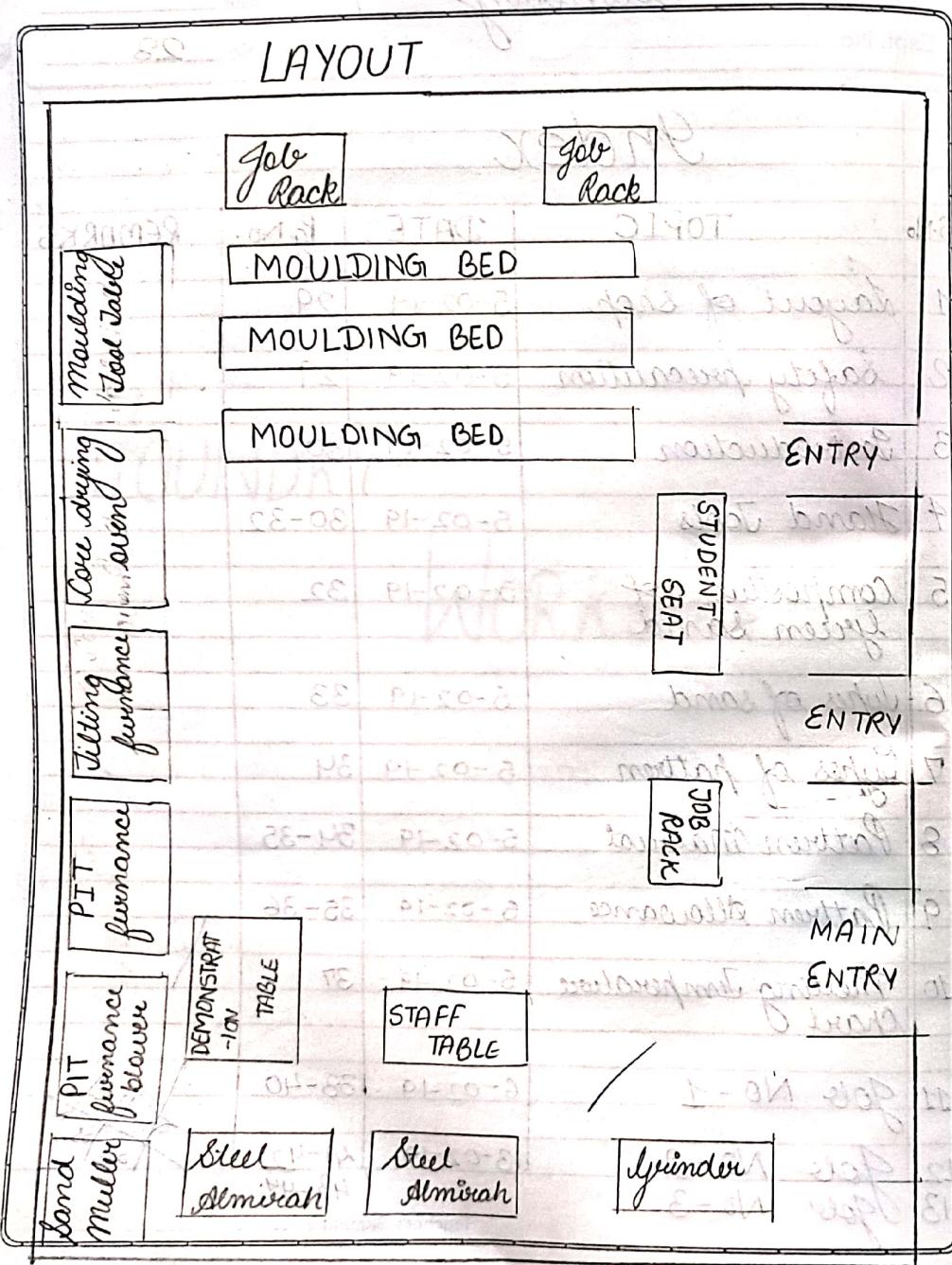
Teacher's Signature : _____

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Safety Precautions

- 1 Always wear gloves, long leather shoes while pouring molten metals
- 2 Keep the path clean while lifting the moulding iron.
- 3 Always keep the mould dry while casting
- 4 Do not walk bare footed on floor.
- 5 Do not wear silky clothes while casting
- 6 Keep the tools at a distance from furnace
- 7 Keep all the tools separated
- 8 Keep the machines well guarded
- 9 Remember the first aid box is near main switch & there is a fire extinguisher in shop
- 10 Always wear uniform in shop.

Teacher's Signature : _____



FOUNDRY

WORKSHOP

2. Foundry

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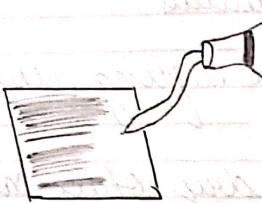
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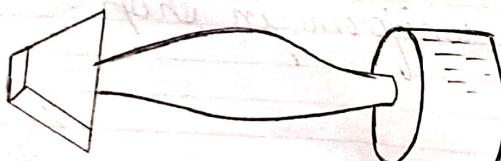
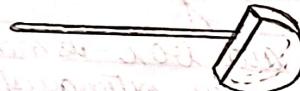
SHOVEL



TROWELS



RIFTER



RAMMERS

Introduction:

Foundry: The place where jobs are prepared by melting and pouring the molten metal into moulds

Mould: A mould is a cavity so prepared that it can be used to make casting by molten metal into it

Pattern: It is a model of anything which is used to prepare mould by placing it in sand

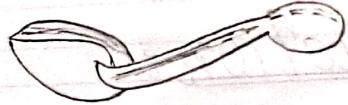
Casting: The molten metal poured into mould on casting

Hand Tools: 1 Shovel: It consists of iron pan with a wooden handle. It is used for mixing & conditioning the sand.

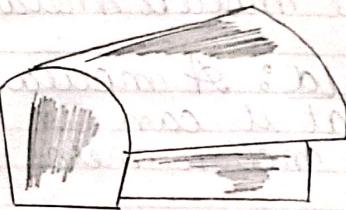
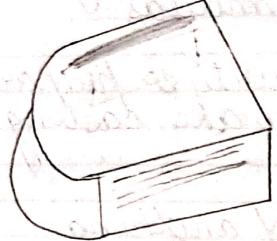
2 Trowels: These are used for finishing flat surfaces and corners inside a mould.

3 Hand Riddle: It is used for sifting of sand to remove foreign material.

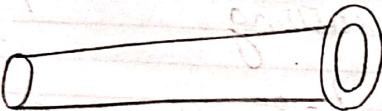
Q2



SLICKS



SMOOTHER & CORNER SLICKS



SPRUCE PIN

3

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- 4 Lifter : It is a finishing tool used for repairing the mould & finishing the mould sand.
- 5 Strike off Bar : It is a flat bar made of wood, used to strike off the excess of sand.
- 6 Dent Alice : It is a thin steel rod or wire carrying a pointed edge at one end & a wooden handle at the other.
- 7 Rammer : It is used for striking the sand mass in moulding box to pack it closely around the pattern.
- 8 Slicks : It is used for repairing & finishing the mould surface & edges after the pattern has been withdrawn.
- 9 Smother & Corner Slicks : It is used for repairing & finishing of flat & round surfaces.
- 10 Scrub : It is a hemp fibre brush used for moistening the edges of sand mould which are in contact with pattern surfaces.

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11. Spruce Pin: It is tapered rod of wood or iron which is embedded in sand & later with drawn it produce a hole.
12. Bellow: It is used to blow out the loose or unwanted sand from surface
13. moulding Boxes or flasks: These are of 2 types
 - a) closed moulding box
 - b) open type sweep flask

Composition of Green Sand

Ordinary Sand.	upto 75%
Clay	8% to 15%
Bentonite	2.5% to 5%
Coal Dust	5% to 10%
Water	7% to 8%

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Types of sand used in casting
are the following. It includes wet sand
or green sand which has high
moisture content.

Another type of sand is dry sand
which has less moisture content.

Experiments are done to find optimum
moisture content.

Optimum moisture content
is about 10%.

The types of sand used

old sand
of slabs
etc etc
old sand
etc etc

hand prepared
I will
done
etc etc

Types of Sand:

- (i) **Green Sand:** It is also known as tempered sand. It denotes a well prepared foundry sand which contains enough moisture.
- (ii) **Dry sand:** This term indicates that molding sand which was originally having excess moisture content.
- (iii) **Facing sand:** It is also known as flat sand. It is sand which forms face of mould.
- (iv) **Parting sand:** This sand is sprinkled on the pattern and the parting surface of mould so that sand mask of flask does not stick to other.
- (v) **Floor Black sand:** It also denotes used sand which is left on floor after casting have been removed.
- (vi) **Core sand:** It contains high silica content and is used for making core.

Change to adult

designed research idea is it : brass casting
brass casting uses a pattern is brass
designing machine which makes pattern
. Brass casting

With aluminum casting will change with
Aluminum has higher brass proportion
of Brass aluminum casting process

talk is brass casting is it : brass pattern
to look which wider basis is it . brass
. brass

no difference in brass with a brass pattern
vacuum casting with brass pattern in
itself is brass basis looks like brass for
hence other than brass

our basis which is it : brass casting with
most pattern will a very nice if it is master
. brass casting

Brass casting design is it : brass pattern
Brass pattern of brass is brass

Types of Pattern:

- The types of pattern to be used for particular casting depends upon many factors
- - 1 Solid or single piece pattern
 - 2 Multiple pattern
 - 3 Fitted pattern
 - 4 Sweep pattern
 - 5 Cope or drag pattern
 - 6 Segmental pattern
 - 7 Two piece or split
 - 8 Match plate pattern
 - 9 Skeleton pattern
 - 10 Pattern with loose pieces.

Pattern Materials:

a) **Wood:** Most common material is wood, due to following reasons

1 It is easy to convert in required shape, size

2 It is economical and easily available but they get affected by atmosphere and more wear and tear

b) **Plaster:** Plaster of paris can be molded very easily to any shape. It has high

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compressive strength and can be used to make pattern of smaller size.

c) Metals: It is used when pattern are made in mass production with more accuracy. It overcome almost every shortcomings of wood.

d) Plastics: It is used to make patterns because of light weight, more strength with little wear, better finishing.

e) Wax: In this mould is divided into 2 halves and rear in this

Pattern Allowance:

a) Shrinkage

a) Shrinking allowance: Most of metals have a tendency to contract during solidification of metal. The amount of shrinkage also differs from metal to metal, the factors that effect the shrinkage are temperature while pouring the metal.

b) Matching Allowance: Machine may be required by casting, may partially or fully. In drawing the position to

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machined is identified and in those portion machining allowance.

c) Draft Allowance: Pattern are given slight taper on all vertical surfaces, this taper is draft allowance. This is either in degree or linear measurements.

d) Shake Allowance: Before withdrawing of pattern, first of all it is shaken so that it is free from adjoining walls due to their size of mould cavity.

e) Distortion Allowance: These are certain casting in which cooling of metal is not uniform throughout the casting due to very complicated shape.

f) Movement of mould walls: Due to excessive heat, the walls of mould, it has a tendency to move their movement of wall affects the final size of casting.

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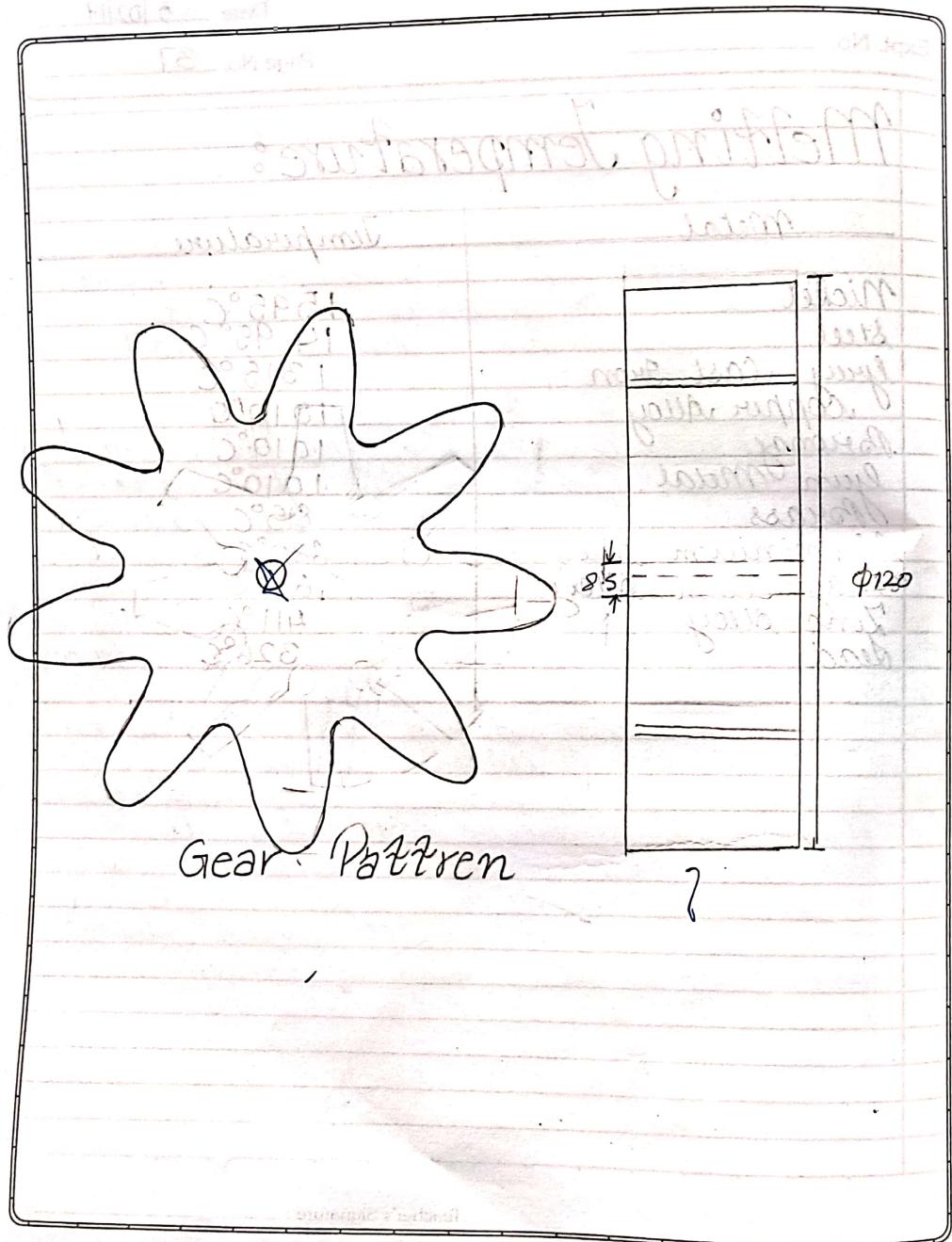
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Melting Temperature:

metal	Temperature
Nickel	1595°C
Steel	1495°C
gray cast iron	1315°C
Copper alloy	1010°C
Bronze	1010°C
tin metal	1010°C
Brass	815°C
Aluminium alloy	680°C
magnesium alloy	650°C
Zinc alloy	411°C
Lead	326°C

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Job No. 1:

Job 2 To prepare a mould of gear pattern

Tool: Shovel, Rammer, Straight edge, smoother, Hand level, hearth and spoon, stick, lifter and cleaner, gate pin, guide pin, venturi, moulding box, spirit level.

Material: Green sand, Parting sand, Aluminium

Procedure:

- 1 Mix the sand with hand and prepare the bed by ramming. Check its level by spirit level.
- 2 Take the pattern and place it on bed and take its impression. Now loose the from that place using hearth sand and spoon stick.
- 3 Place the pattern on loose sand. Push the pattern by keeping straight edge over it by striking with hammer.
- 4 Pour parting sand on top of bed

Teacher's Signature : _____

Left side

Keep a basin at a distance of 3-4 ft from the pattern.

Now take the pattern & basin. Insert
the pattern in the basin, with sand around
it. Now mix the sand & pour it by
level bridge. Level sand around

the pattern, basin etc. & level

Now after basin mix sand & pour it
around the pattern & make a rough
surface with help of wooden stick

Now after it help the sand with help of
wood stick & moulding box. Now
make smooth surface and take more sand
with help of hand

and put sand on pattern with help of
hand & smooth surface with help of
wood stick. Now take the pattern & basin
and pour sand on the pattern & basin

and to open the base of casting mold

- 5 Place the moulding box on bed in such a way that pattern should not be in centre
- 6 Set the gate pin at a distance of 1 inch from pattern and pour fine sand over it.
- 7 Ram the sand to level of moulding box
- 8 Use vent wire for venting the surface to allow gases to escape
- 9 Now place guide pins on four corners of box at 15° to 30° angle.
- 10 Now remove gate pin and make funnel with help of stick
- 11 Remove moulding box, sand cut the passage in space for molten metal
- 12 Now remove the pattern by loosening it with help of draw spike
- 13 Clean mould cavity with help of hand below and place the box over it
- 14

we set up the apparatus like this
it includes a stand, bulb, bulb holder
and a bulb.

so when a bulb goes off it is
a sign that the bulb would become
it was broken completely

maximum for heat at home with max 15

so you can't use a bulb for more than 15
before it'll stop working again.

number must go, and when would break
bulbs break it is good for

idem break up stop working again or
will go again after time up

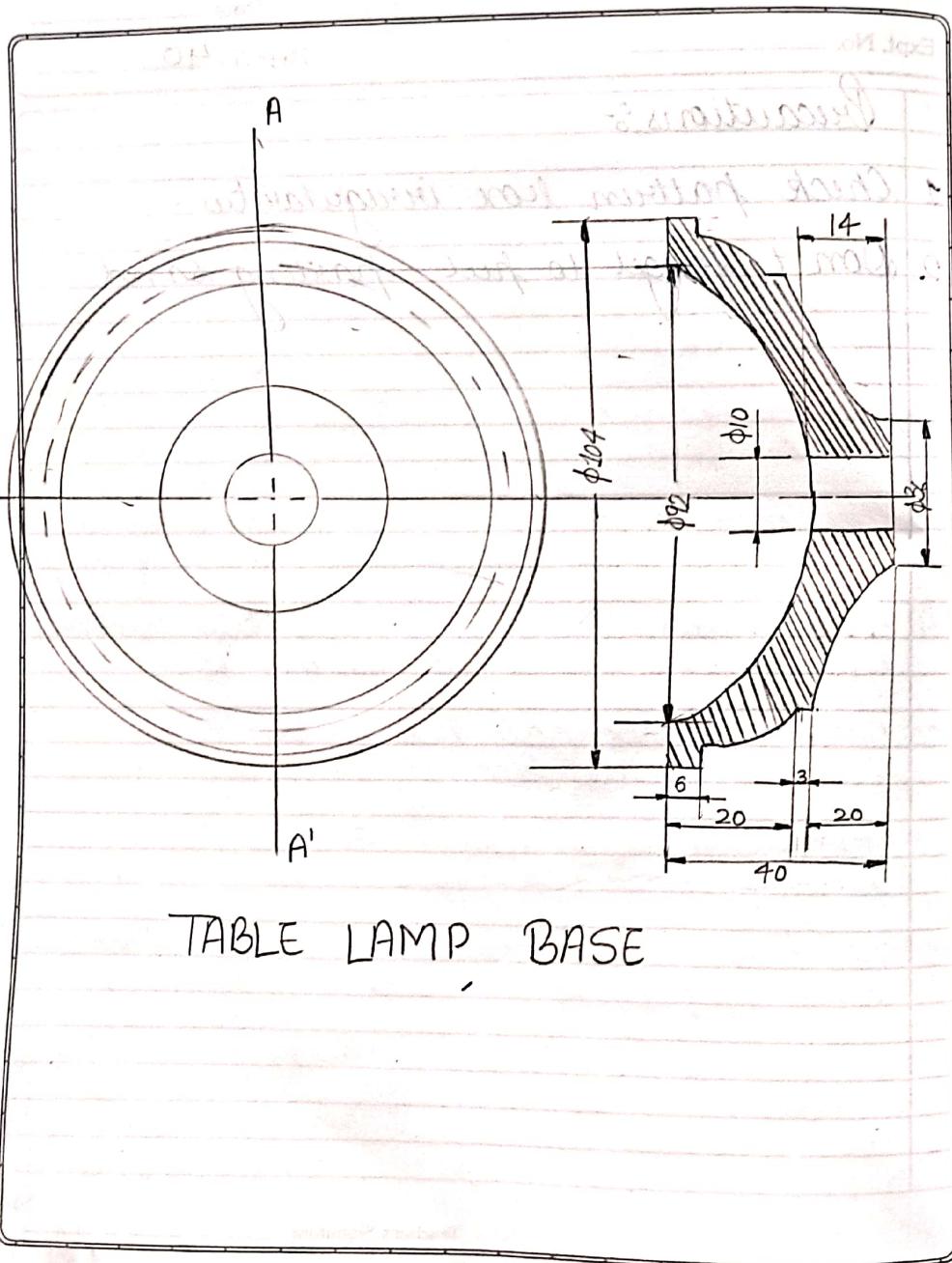
so we have got positions named 11
before return back with the power

so person will switch it, number eight
is a bulb which is good when

so that they don't damage and
they break the bulb so it's good when

Precautions :-

- 1 Check pattern box irregularities.
- 2 Don't forget to put starting sand.



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Date 13-02-19

Expt. No. 2

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Job No-2

Job : To prepare a mould of a table lamp base pattern

Tools : Shovel, Rammer, Straight edge, Hand Bellow, Smoother, Blauth, Spoon slick, lifter, cleaner, gate pin, guide pin, Vent wire, moulding box

Material : Green sand, parting sand, Aluminium.

- 1) Check the moisture of sand by making ball of sand and apply pressure on it with hand. If less hand pressure impression and flakes little process do break then moisture of sand is ok.
- 2) Mix the sand with hand and prepare the bed by ramming. Check its level by spirit level.
- 3) Take pattern & put it on bed and takes its impression. Now took the sand from that place with help of hearth and spoon slick.
- 4) Place the sand pattern on loose sand, push the pattern by keeping straight.

Teacher's Signature :

So off stop

Now a pattern is required so i took
a rectangular block and made

a gate pin hole inside it. Now i took
a small rectangular block
and put it inside the hole. Now make
the pattern with that and pour

molten metal. After removing the sand
mould.

Now its inside the mold & a vertical
pin has been made in the pattern pin
hole which is to be removed by
using hammers hammering around. Now
when we remove the pin it will
be in hole. So if we
want to remove the pin then
we have to break the mold. So
we will remove the mold in this
place where there is no metal.
So after removing the mold, now
there is no metal. Now the
process of removing the mold is over.

edge over it by striking with hammer.

5 Pour parting sand on top of it

6 Place moulding on sand in such a
way that pattern should not be at centre

7 Set the gate pin at distance of 1" away
from pattern and pour the sand
over it

8 Ram the sand to level of moulding
iron. Use vent wire for venting the
surfaces to allow gases to escape

9 Now place the guide pin and make
at four corners leaving 25 mm from
corner of iron at angle of 15° to 30°

10 Now remove gate pin and make funnel
with help of stick.

11 Remove moulding iron and cut passage
in 1" space last molten metal.

12 Now remove the pattern by loosening it
with help of spike and repair should
if required

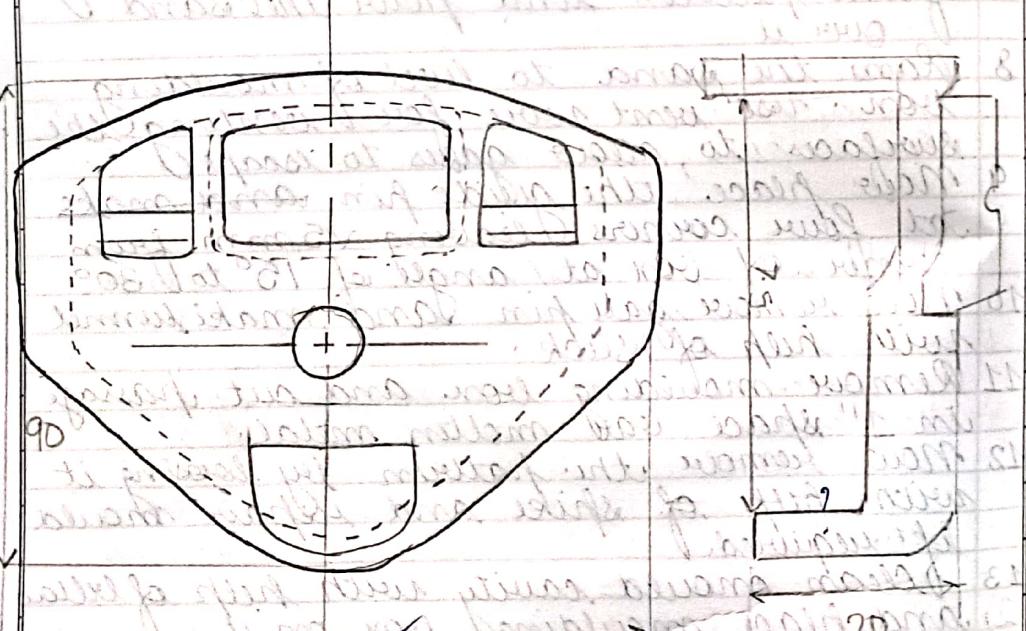
13 Clean mould cavity with help of bellows
and place moulding iron on it

14) Precautions : 1 Check the irregularities
in moulding iron

2 Donot forget to pour parting sand.

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Job - 3 : To prepare a mould of a Table lamp base pattern

Tools : Shovel, Rammer, Straight Edge, Smoother, Hand trowel, Slick, lifter and cleaner, Gate Pin, Guide Pin, Vent wire, Moulding Box

Material : Green Sand, Parting Sand, Aluminium

Procedure :

- 1 Check the moisture of sand by making a ball with hand & applying pressure with hand gives hand impression & takes little pressure to break, then moisture is O.K.

- 2 Mix the sand with hand & prepare box by ramming. Check its level by straight edge.

- 3 Take the pattern and put it on box & take its impression. Now loose the sand from peace with help of spoon stick.

- 4 Place the pattern on loose sand. Push the pattern by keeping the st. edge over it by striking with Rammer.

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- 5 Pour parting sand on top of cast.
- 6 Place the moulding bed in such a way, that pattern should not lie in centre.
- 7 Set Gate pin on top pattern & pour the sand over it.

2

~~Singh~~
~~105~~

Teacher's Signature : _____

Fitting

Welding
Welding
Welding

Welding
Welding
Welding

Welding
Welding
Welding

Fitting 45'

Date 26

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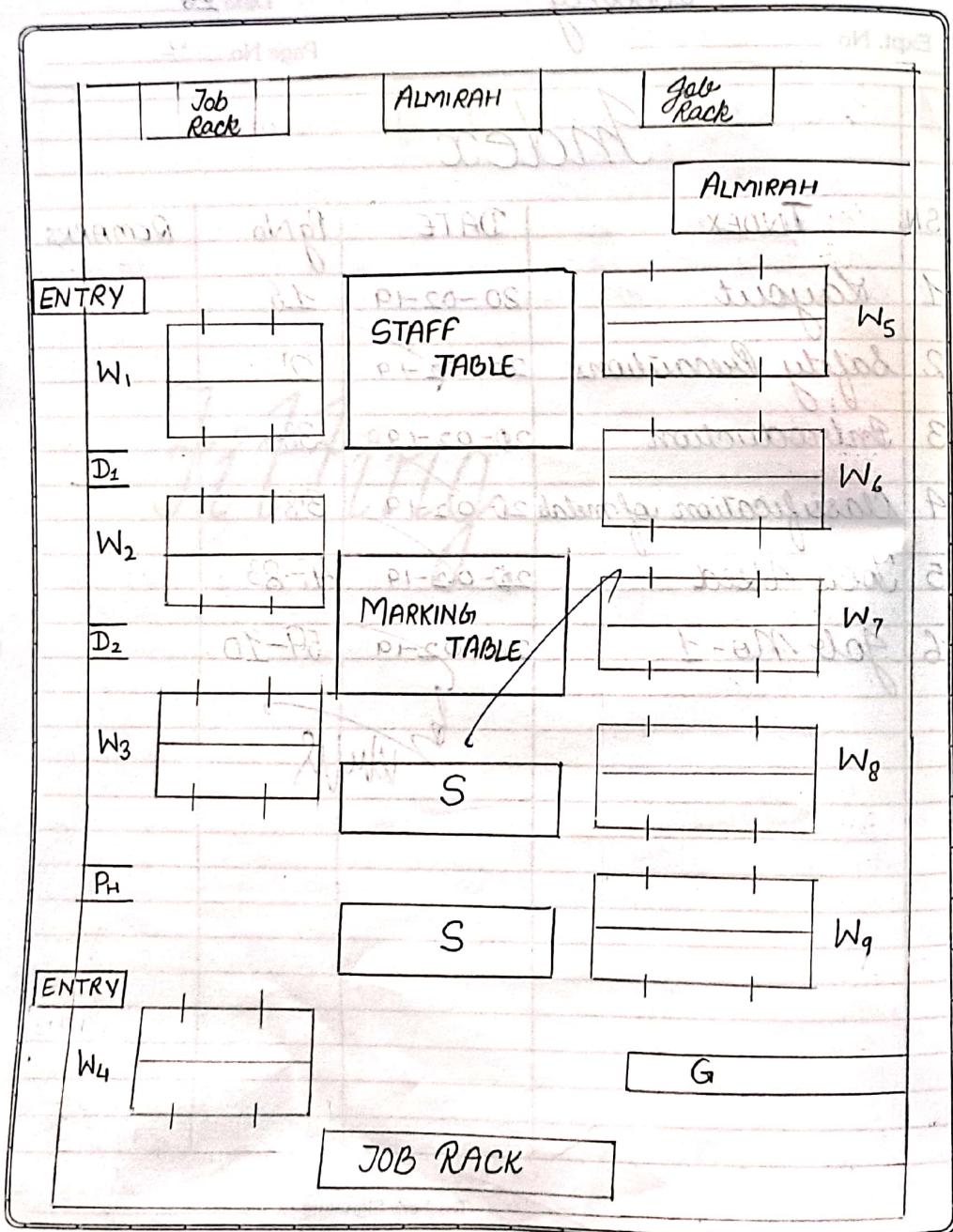
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2
16u/18

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Date 20-02-19

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Layout

Equipments of fitting shop.

W = Working Table

S = Surface Plate

D = Drilling Machine

G = Grinding Machine

PH = Power Hacksaw.

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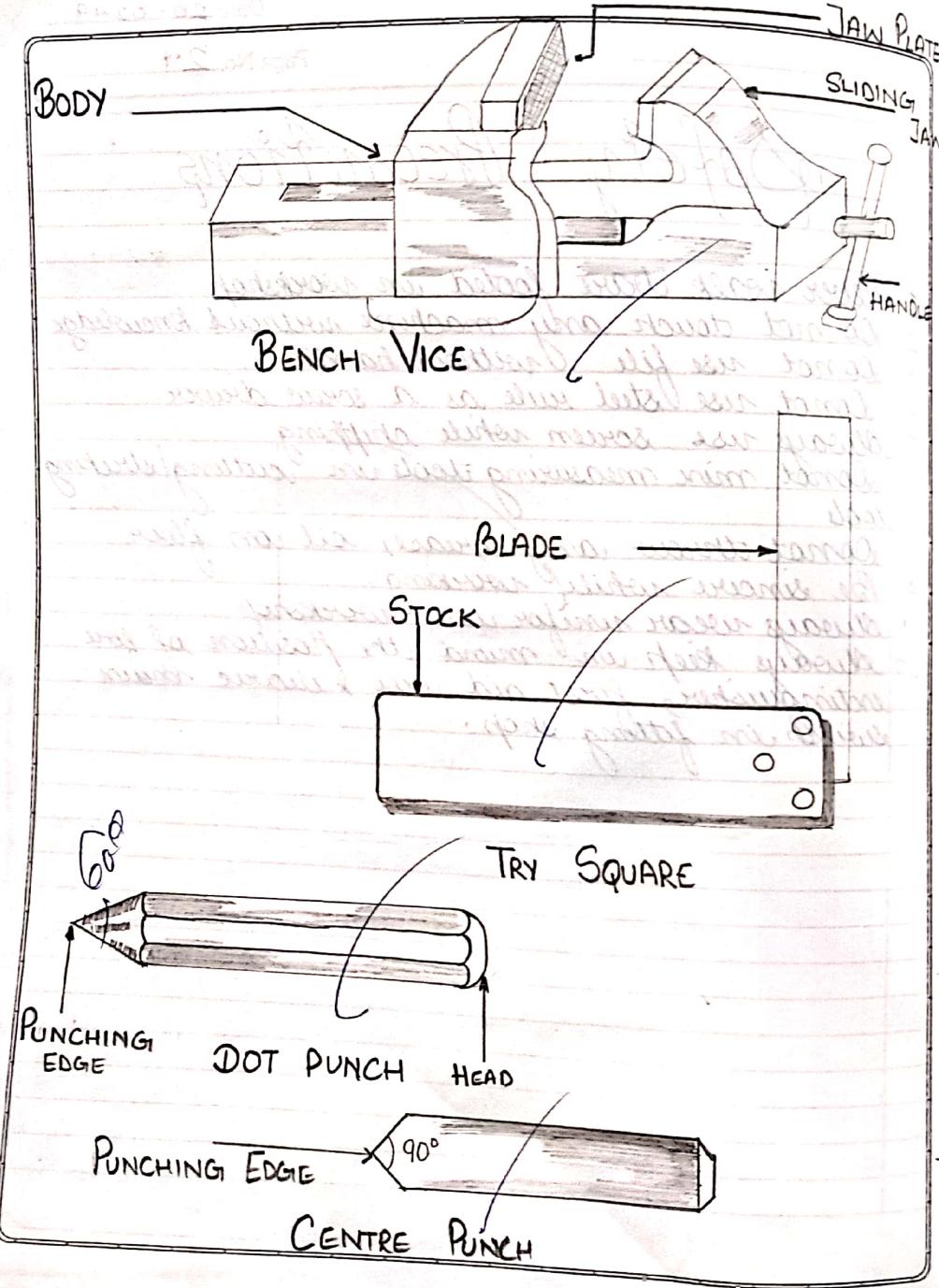
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Safety Precautions

- 1 Never walk bare footed in workshop
- 2 Do not touch any machine without knowledge
- 3 Do not use file without handle
- 4 Do not use steel rule as a screw driver
- 5 Always use screen while shipping
- 6 Do not mix measuring tools in cutting/strking tools
- 7 Do not throw any grease, oil on floor
- 8 Be sincere while working
- 9 Always wear uniform in workshop
- 10 Always keep in mind the position of fire extinguisher, first aid box & electric main switch in fitting shop.

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Date 21-02-19

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Introduction: Fitting work is very important work in engineering. In fitting shop, unwanted material is removed with help of hand tools. It is done for mating, repair and manufacturing of parts for purposes. The person working in fitting shop is called fitter.

Classification of Metals:

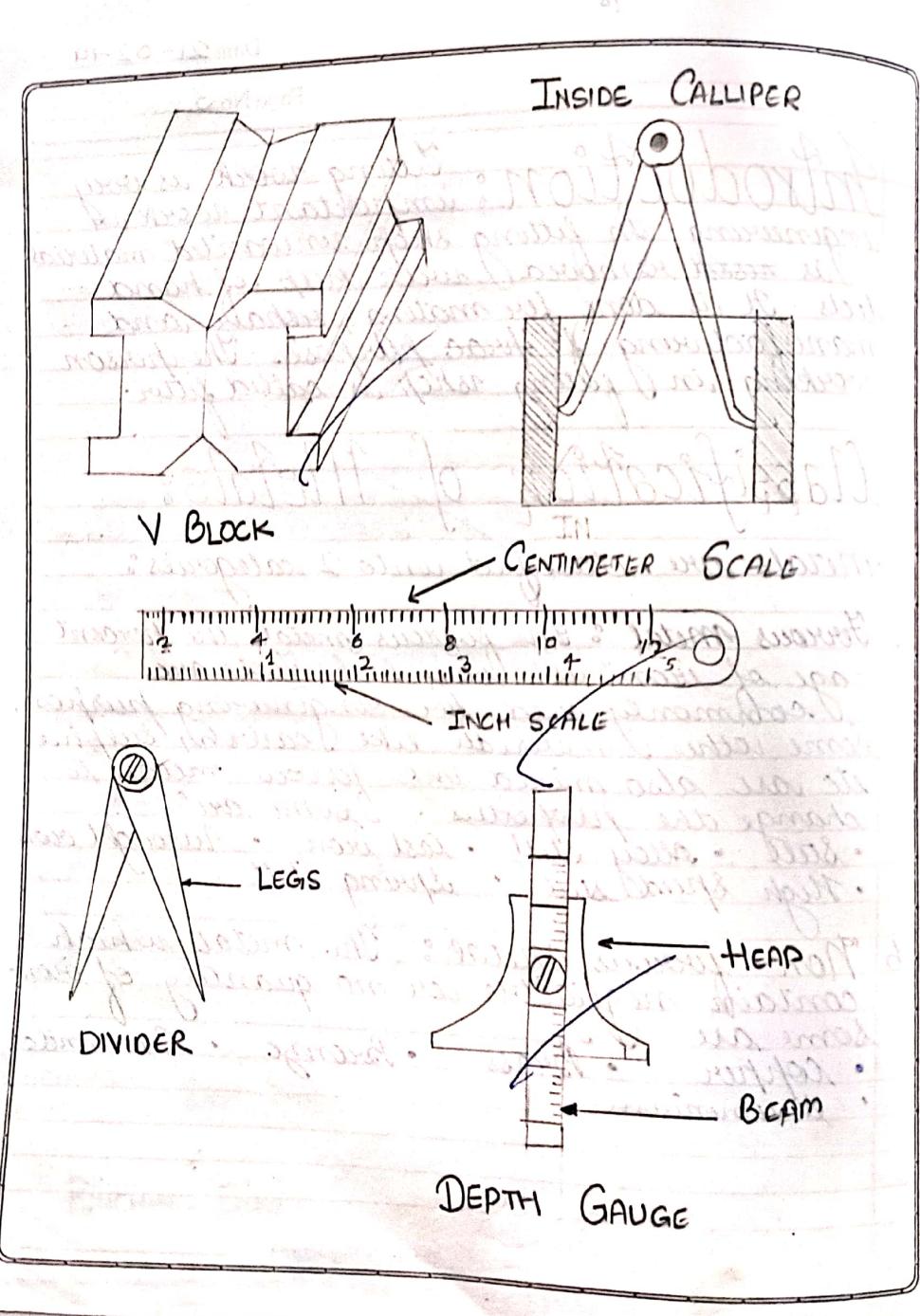
metals are classified into 2 categories:

a) **Ferrous metal:** In ferrous metal, the percentage of iron is very high. These are commonly used for engineering purposes. Some other materials like Carbon, Sulphur etc. are also mixed into ferrous metals to change the properties. Some are:
 - Steel : Alloy steel • Cast iron • Wrought iron
 - High speed steel • Spring steel.

b) **Non-ferrous metal:** The metals which contain negligible or no quantity of iron. Some are

- Copper • Brass • Bronze • Gun metal
- Aluminium

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Date 21-02-19

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1 Tools Used:

a Holding & Clamping Tools:

(a) **Pinch vice**: It is used to hold the jobs. Material is cast iron. Principle of this vice is nuts & bolt.

(b) **Hand vice**: It is used to hold small job. Material is mild steel. Principle of this vice is nut & bolt.

(c) **Machine vice**: It is used to hold jobs for drilling. material is mild steel. Principle is nut & bolt.

(d) **Jap Handle**: It is used to hold taps. material is mild steel.

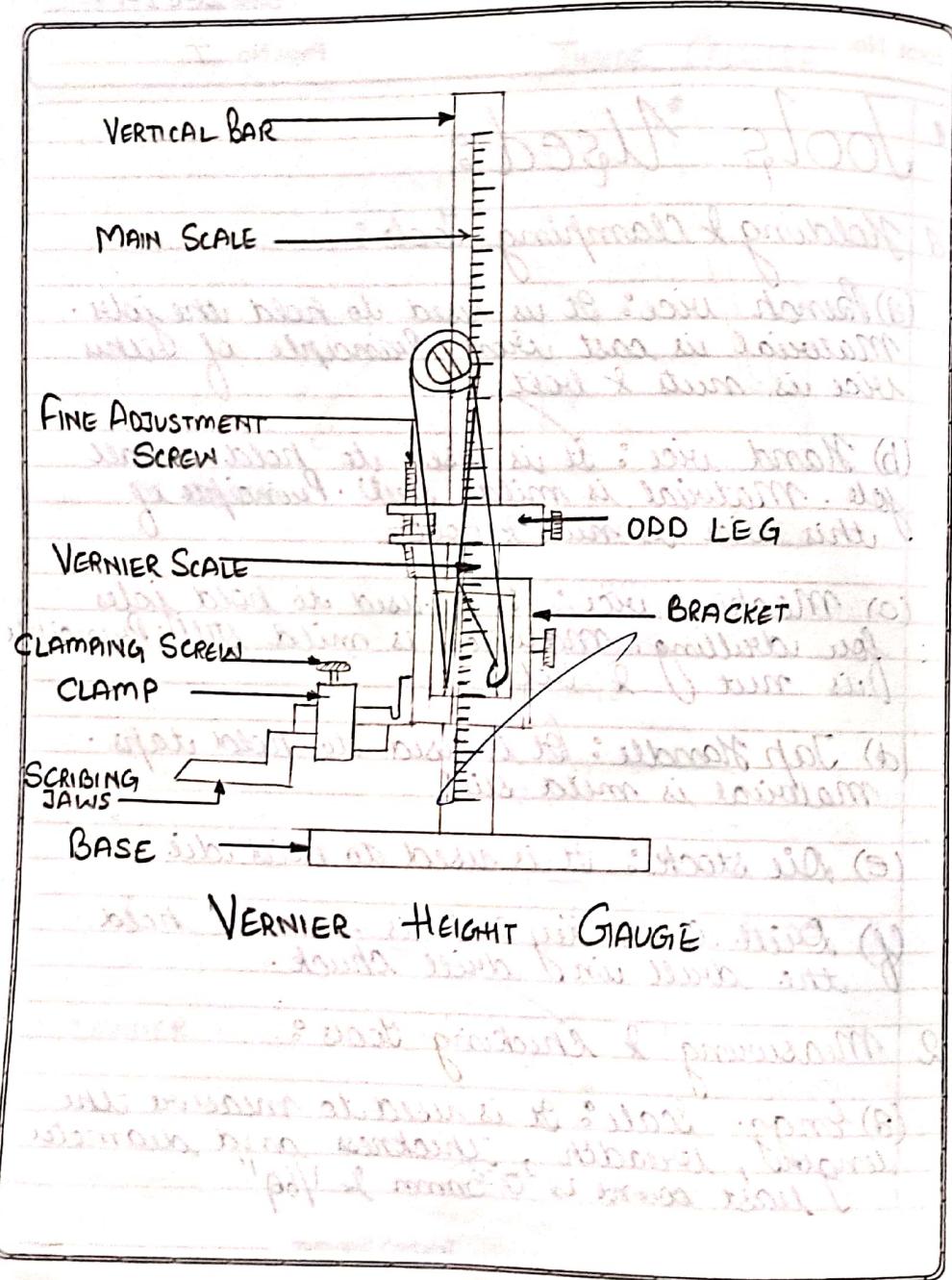
(e) **Die stock**: It is used to hold die.

(f) **Drill Chuck Key**: It is used to hold the drill and drill chuck.

2 Measuring & Checking Tools:

(a) **Engg. Scale**: It is used to measure the length, breadth, thickness and diameter. Least count is 0.5mm & 1/64".

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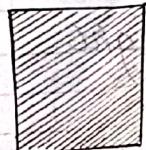
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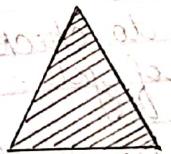
- b) Try Square : It is used to check right angle and straightness of job.
 - c) Depth Gauge : It is used to check right angle & depth of hole.
 - d) Angle protractor : It is used to check the angles of job.
 - e) Spring Type Out side Caliper : It is used to check out side outside diameter, length, width & thickness.
 - f) Spring Type in Side Caliper : It is used to check internal sizes of job.
 - g) Vernier Caliper : It is used to check out side diameter, inside diameter and depth of hole.
- 3) Marking & Supporting Tools :
- a) Scriber : It is used to mark lines on metals.
 - b) Odd leg Caliper : It is used to draw parallel lines.
 - c) Spring Dividur : It is used to draw circle and divide circles & lines.

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DIFFERENT SHAPES OF FILES



Square



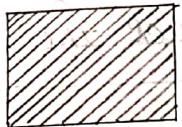
Triangular



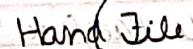
Round



Half Round



Flat



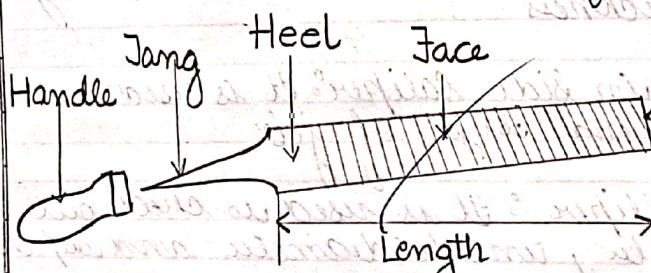
Hand File



Knife Edge



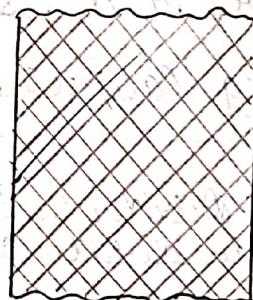
Diamond



Parts of File



Single Cut File



Double Cut File

S1

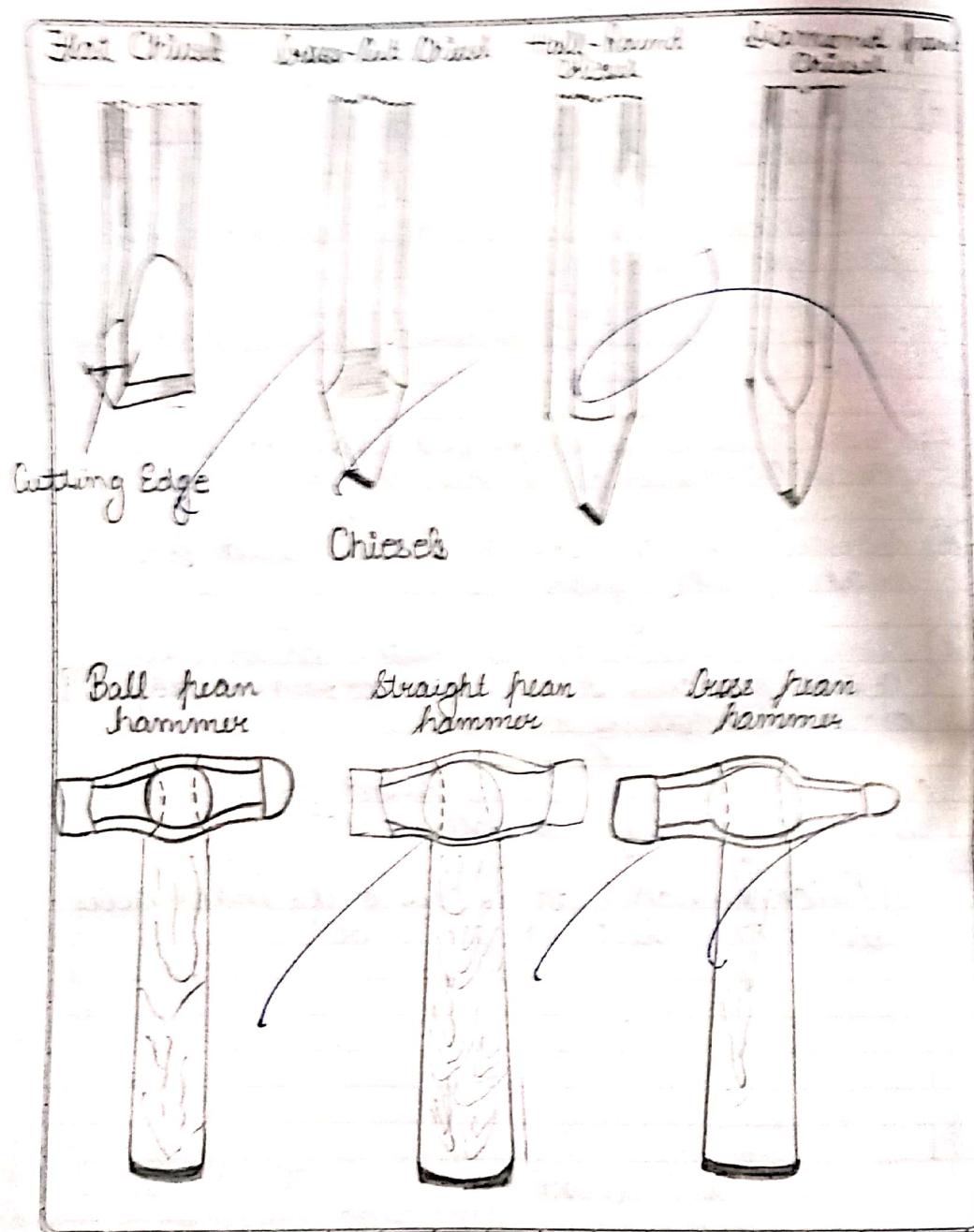
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- d) Universal Marking Gauge : It is used for marking the jobs.
- e) Vee-Block : It is used to support the job for marking.
- f) Marking Table : It is used to support the jobs for marking.
- g) Anvil : It is used to support the jobs for hammering & punching.
- h) Vernier height gauge : It is used for marking the jobs.
- i) Punches : Material is high carbon steel.
- (i) Dot punch : It is used to mark dots on line, angle is 60° .
- (ii) Centre punch : It is used to mark a spot for drilling, angle is 90° .
- (iii) Quick Punch : It is used to make holes in thin sheets, angle is 30° .

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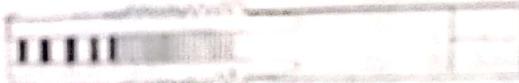
a) Cutting Tools:a) Horseshoe chisel: It is used to cut metal.b) Square chisel: It is used to make a hole in metal by high speed steel.c) All-round chisel: It is used to finish the rough hole.d) Diamond chisel: It is used to cut internal grooves.e) Tape: It is used to cut internal grooves. There are 3 types:i) Wiper tape: It is used to clean out the groove.ii) Medium tape: It is used after wiper tape.iii) Partitioning tape: It is used to cut the internal narrow hole in profile.f) Chisels: It is used to cut the metal and chipping operations.Angle θ is 60° to 70° .

There are 2 types:

(i) flat chisel: It is used to cut metal from external surface.(ii) Cross-cut chisel: It is used to cut metal from grooves and narrow place.

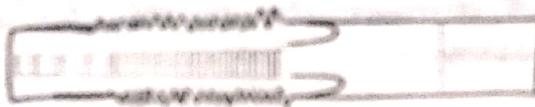
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8-10 Jaws



Type Jap 1st Japan

3-4 jaws



Medium Jap 2nd Japan



Kettomung Jap 3rd Japan

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- (i) File : It is used to remove metal. Material is high carbon steel.
- (ii) Filing : It is used to remove metal from external surface.
- (iii) Round : It is used to enlarge diameter of hole.
- (iv) Half round : It is used to make semi-circle.
- (v) Square : It is used to make square shape.
- (vi) Chamfer : It is used to remove metal from corners.
- (vii) Knife edge : It is used to remove metal from tight and narrow places.

3 Striking Tools

Hammer : It is used for hammering purpose. Material is medium carbon steel.

- (i) Ball peen hammer : It is used to hit the rivets.
- (ii) Cross peen hammer : It is used to bend thin cross & metal pieces.
- (iii) Straight peen hammer : It is used to bend metal pieces.

Teacher's Signature _____

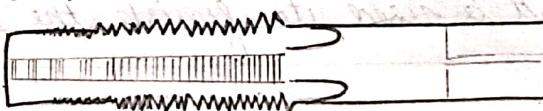
8-10 threads



Taper Jap

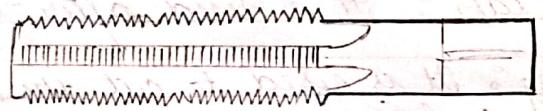
1st taper

3-4 threads



Medium Jap

2nd Japer



Bottoming Jap

3rd Japer

- (g) Files : It is used to remove metal. Material is high carbon steel.
- (D) Flat : It is used to remove metal from external surface.
- (II) Round : It is used to enlarge diameter of hole.
- (III) Half round : It is used to make semi-circle.
- (IV) Square : It is used to make square shape.
- (V) Triangular : It is used to remove metal from corners.
- (VI) Knife edge : It is used to remove metal from grooves and narrow places.

5 Striking Tools

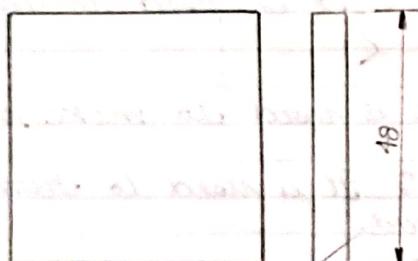
Hammers : It is used for hammering purpose. Material is medium carbon steel.

- (I) Ball peen hammer : It is used to hit the rivets.
- (II) Cross peen hammer : It is used to bend thin sheets & metal pieces.
- (III) Straight peen hammer : It is used to bend metal pieces.

Date 26-02-19

Job No.1:

FILING PRACTICE



Material: MS Flat

ALL SIZE IN MM

1. Required Size: 50x50x6.5

2. Basic Size: 48x48x6

Affassance: a) Cutting = 1mm

b) Filing = 1mm

Tolerance: ± 0.25 mm

Expt. No. _____

Page No. _____

Job No.1: Filing Practice

Tools: File, hand hacksaw, try square, Engineering scale, Bench Vice, Vernier calliper & Vernier height gauge.

Material: M.S. Flat

- Procedure:
1. Check the straightness of material to be cut by try square.
 2. Mark the line by adding cutting & Filing allowance.
 3. Clamp the material in Bench Vice & grip it lightly.
 4. Check hand hacksaw for direction of teeth and tightness before use.
 5. Cut the work piece with hacksaw and
 6. Check the handle of rough/bastard file before use it should be tight properly.
 7. Mark one surface for job by applying various filing methods.
 8. Then prepare its reference and adjacent side in some manner as surface is prepared.
 9. After the surface & sides are prepared apply the chalk paste and complete the marking as per drawing.

Teacher's Signature: _____

10. Remove the unwanted material with hand hacksaw. Check the size & finish the job from all sides with help of smooth file.

D 40

- Precation:

 1. Donot use Rough/Best and file without handle.
 2. Donot use Rosewood file and try square as hammer.
 3. Donot strike hammer on surface plate.
 4. Donot use Engineering smile as screw driver.
 5. Donot mix cutting tool in measuring Tools.

Teacher's Signature :-

Machine INDEX

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1	Safety Precautions	56	6-03-19	
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10	Specifications of Lathe Machine	69	7-03-19	b 02/04/19

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Date 6-03-19

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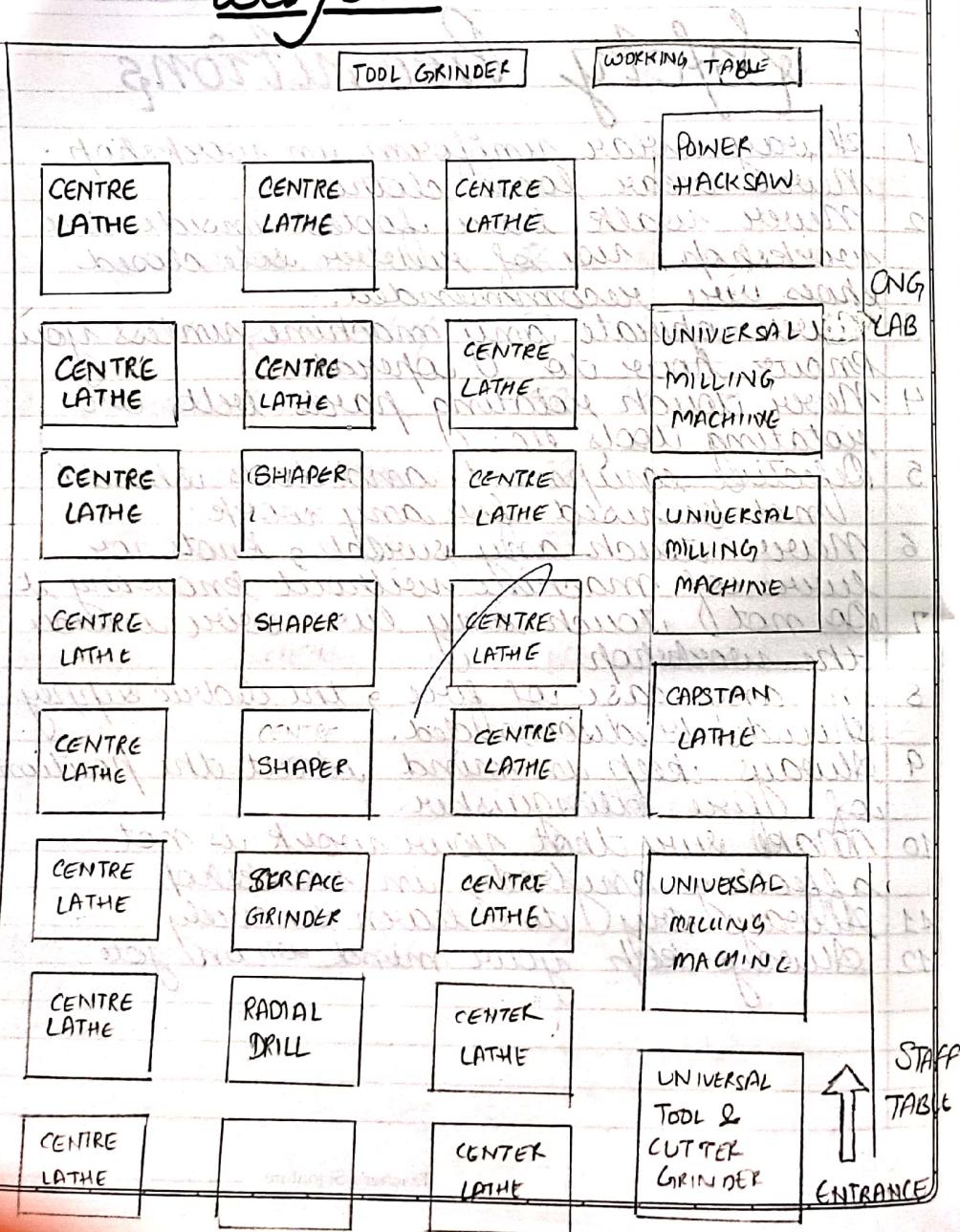
Page No. _____

Safety Precautions

- 1 Always wear uniform in workshop.
Never wear loose clothes.
- 2 Never walk bare footed inside the workshop, use of rubber sole closed shoes are recommended.
- 3 Never operate any machine unless you know how to operate.
- 4 Never touch rotating parts belts or rotating tools etc.
- 5 Defective equipment and tools should not be used for any work.
- 6 Never touch any switch, knobs or levers of machine without knowing it.
- 7 Do not touch any live wire inside the workshop.
- 8 In any case of fire, the electric supply should be disconnected.
- 9 Always keep in mind about the position of fire extinguisher.
- 10 Make sure that your work is not affecting anybody in workshop.
- 11 Always try to learn sincerely.
- 12 Always keep your mind on job.

Teacher's Signature : _____

Layout



Expt. No. _____

Page No. _____

Introduction:

The shop where most of the work is performed on different machines is called machine shop. In machine shop, the raw material is cut, machined, formed or shaped with help of machines. Different machine used in machine shop are:

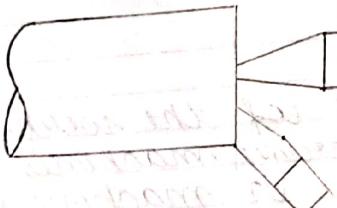
- 1 Lathe machine
- 2 Milling machine
- 3 Shaper
- 4 Planing machine
- 5 Drilling machine
- 6 Threading machine.

Types of Lathe Machine:

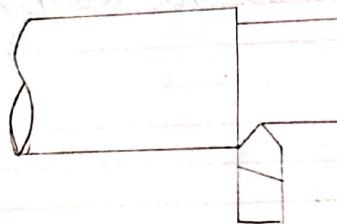
There are various type of lathe.

- 1 Precision lathe
- 2 Capstan and turret lathe
- 3 Tool room lathe
- 4 Automatic lathe
- 5 Speed lathe
- 6 Engine lathe
- 7 Bench lathe
- 8 Special purpose lathe.

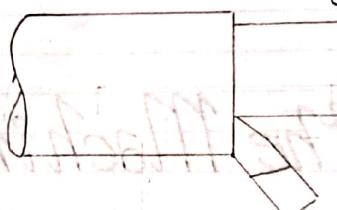
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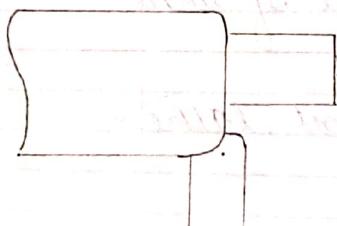
Facing



Rough



Shouldering



Radius Turning

Operation on Lathe Machine

The following operations can be performed on lathe machine :-

- 1 Facing
- 2 Rough turning
- 3 Shouldering
- 4 Necking
- 5 Radius turning
- 6 Taper turning
- 7 Thread cutting
- 8 Forming
- 9 Chamfering
- 10 Knurling
- 11 Drilling
- 12 Boring
- 13 Counter sinking
- 14 Counter Boring

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Vernier Calliper

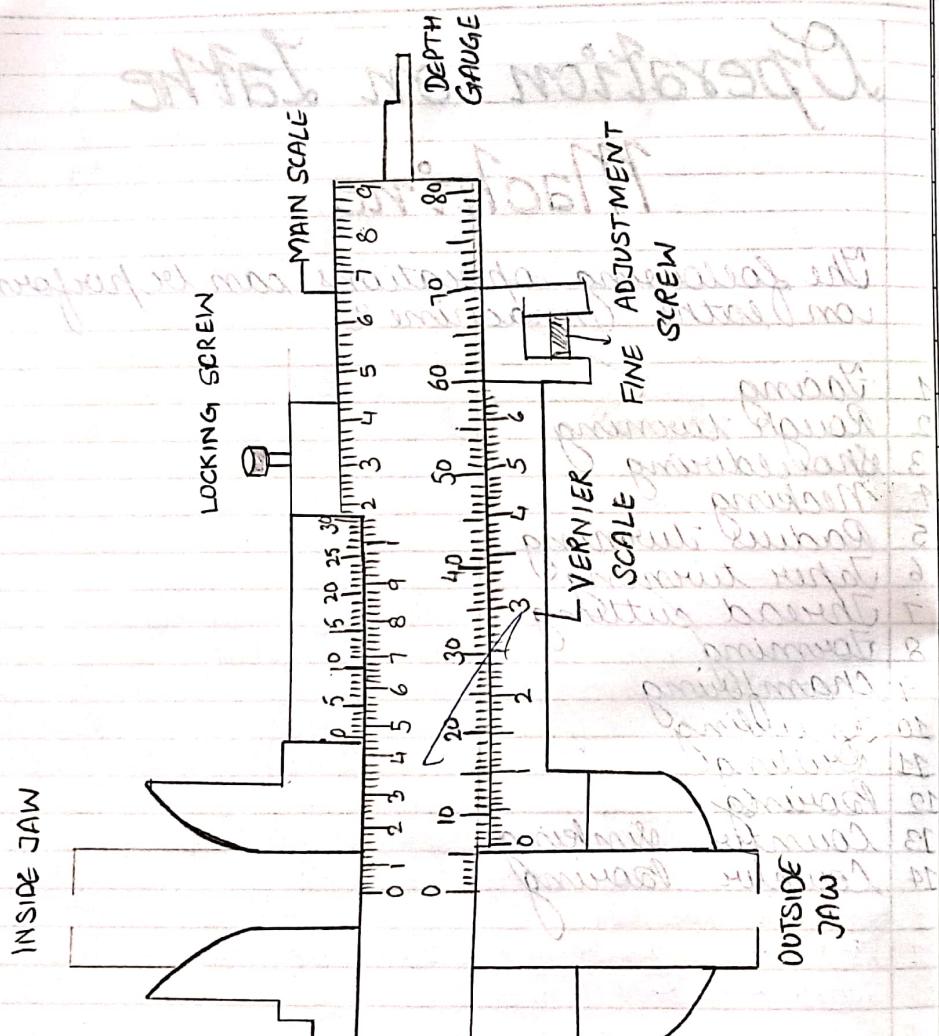
This device is used to find internal and external diameter with an accuracy of 0.02 mm and 0.01 inch. It has 2 scales : first is vernier scale and second is main scale.

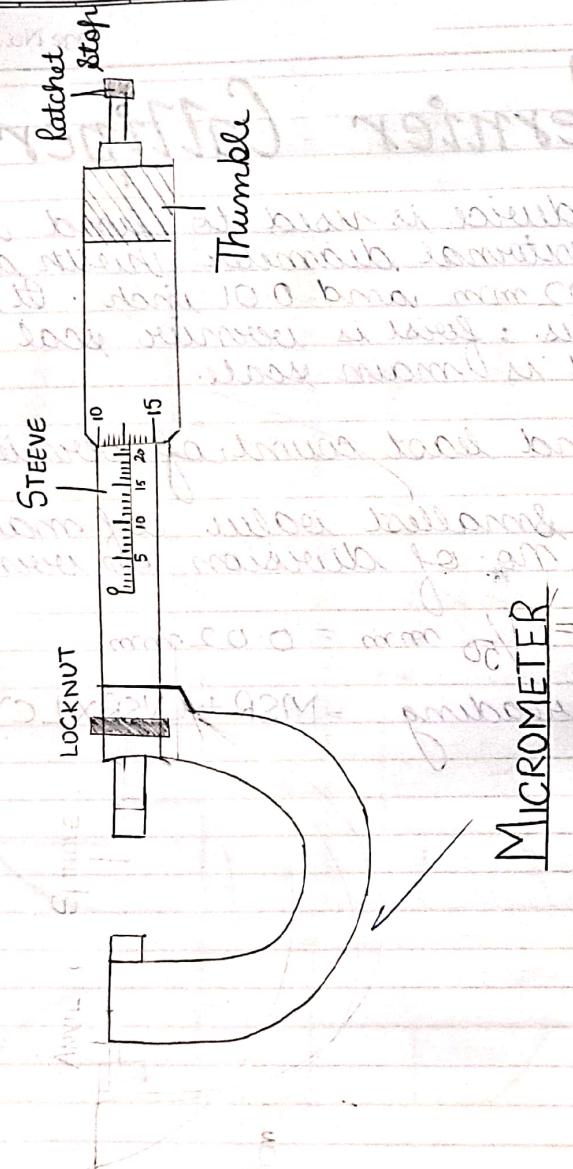
To find least count of vernier scale

$LC = \frac{\text{smallest value of main scale}}{\text{no. of division on vernier scale}}$

$$= \frac{1}{50} \text{ mm} = 0.02 \text{ mm}$$

Total reading = MSR + (VSR \times LC)





Expt. No. _____

Page No. 5

Micrometer

It is used to find thickness of any job. It is more precise than vernier caliper. It consists of hook type frame. By turning spindle, the job is measured from scale. The sleeve on the spindle is graduated. A barrel fitted outside of sleeve is attached with spindle. This barrel is also graduated. It is measured in inch as well as in mm.

LC of micrometer is $0.001''$ or $0.0001''$ or 0.01mm or 0° .

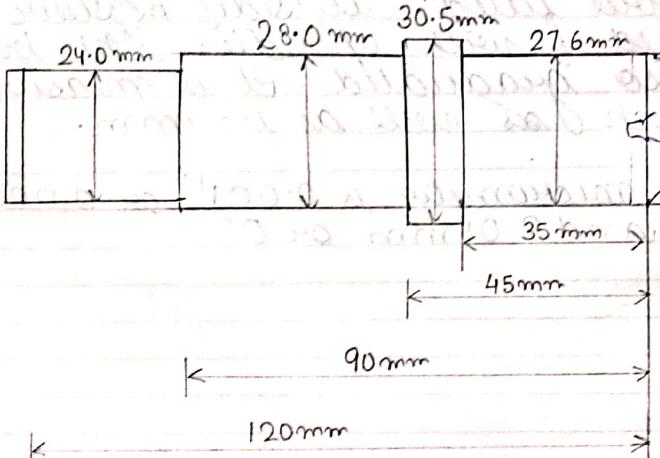
Material: MS bar, 2.5 mm thick

Procedure:

1. Fit the two thickness gauge plates between the jaws of a vernier caliper having a span of 180 mm. 2. Turn the micrometer spindle until the job is held firmly and the work is held in the frame. 3. Turn the thumbscrew and go about 1/4 turn to zero the micrometer.

Teacher's Signature : _____

Exp No-1 STEP TURNING



TOLERANCE: $\pm 0.2\text{mm}$

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Date 7-03-19

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Page No. _____

Exercise On Lathe Machine

Ex-1

operation: \rightarrow plain turning, step turning, facing and chamfering.

Tools & Equipments Used: \rightarrow

- | | |
|-----------------------------------|--------------------------------|
| 1 Machine | centre lathe machine |
| 2 Cutting Tool | V-shape cutting tool |
| 3 Measuring Instrument | Steel foot rule |
| 4 Dead centre or revolving centre | Normed calliper, surface gauge |

Material: MS Bar 32x140mm (dia x length)

Procedure:

- 1 Hold the bar stock in four jaw chuck in such a way that at least 180 mm of bar stock is projected outside the chuck the one end of work piece is held in chuck and the other end in dead and revolving centre.

Teacher's Signature : _____

small shaft in seasons

prepared with a piece of soft wood
and then the jaws are closed.

→ hold at angle & cool

→ hold until cold. → when it is
cold cut the jaws → hold part in
the tail stock. → remove carbide
bit from tool & fit a new one hold it
properly in jaws

(long axis) mm 1000 & dia 2M : 35mm

smooth

→ turn rough on all tools not in hole
→ carbide tool is used for a rough
cut. When the carbide becomes dull hold
it back in hole & turn for one more
revolution. Hold the tool with hand
when you

- 2 The work is centered so as it rotates exactly around its centre axis for this touch the needle of surface gruges on top near the chuck and rotate four jaw chuck in hand. It should touch all around the job. If it is displaced so bring it in center, loosen the opposite jaws and tightened the jaw where it touches the needle.
- 3 Hold the turning tool past in such a way that it projects out of tool post as little as practicable to avoid leverage i.e. approve 30mm-35mm. The cutting edge of tool should coincide with centre axis of work piece.
- 4 The larger diameter is obtained by giving one or more rough cut then finally a finishing cut of not more than 0.75 mm. The direction of cut should be towards the headstock.
- 5 Reduce the dia 30.5 mm to 27.6 mm by rough and finish cut up to length 35 mm from face by simple turning.
- (1) Make 120 mm length from face and reduce the dia to 26 mm after 45 mm length from face and up to mark of 120 mm

Expt. No. _____

Page No. _____

from face end.

- (2) Again mark 70 mm length from face end the dia if from 28 mm to 24 mm from this mark upto 120 mm mark.
- 6 All the faces of different steps are faced with the help of parting off tool.

- 7 Chamfering is done at edge of 24 mm dia and 27.6 mm dia and the work piece in.

Manufacturing Tools required:

Cutting Tools: Chisel, Parting off tool, Chamfering tool.

Measuring Tools: Vernier calliper.

Work holding Tools: Vice, Centre punch.

Other Tools: Drills, Hammers, Gages.

Procedures:

1. Heat the work piece in fire for 10 min.

2. After heating, take the work piece in the vice.

3. Now take the chisel and part the work piece.

4. Now take the parting off tool and part the work piece.

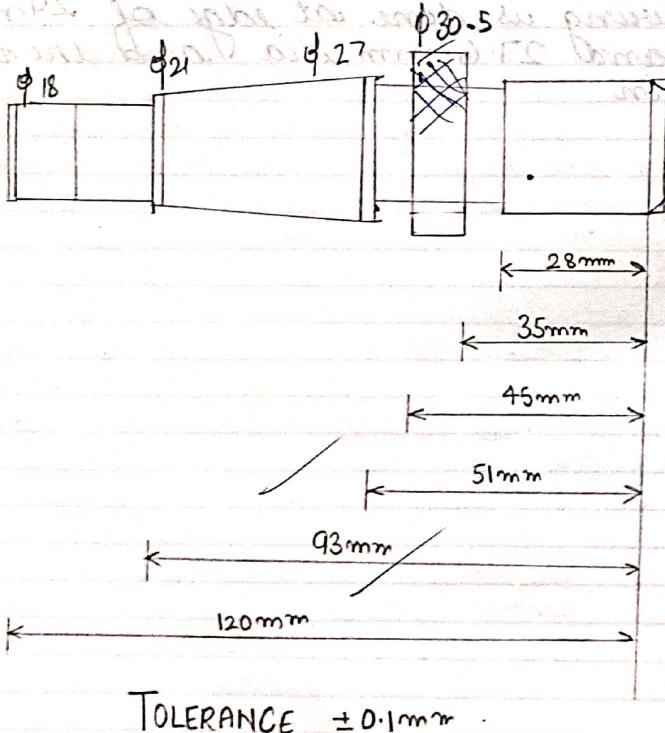
5. Now take the chamfering tool and chamfer the edges.

6. Now take the gages and check the sizes.

7. Now take the vernier calliper and measure the sizes.

Teacher's Signature : _____

Exp No-2 Taper Turning



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Date 7-03-19

Expt. No. _____

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Exercise 2 - Exercise on Centre Lathe Machine

Operations: plain turning, step turning, facing, grooving, taper turning, knurling, V. shape threading, chamfering etc.

Machine tool: Centre lathe machine

Manufacturing tool: Vernier calliper, screw gauge.

Cutting tool: V shape cutting tool, threading tool, grooving, revolving centre and knurling tool

Material: MS bar 3.7 dia and 140mm length

Procedure:

- 1 Hold the bar stock in four jaw lathe chuck in such a way that at least 130 mm of bar stock is projected outside. The chuck the one end of work piece is held by the chuck and the other end in dead or

Teacher's Signature : _____

ପ୍ରାଚୀନତାଙ୍କି - ଲୋକତାଙ୍କି

principio delle pressioni: risip: profondità
e pressione degli strati e pressione e peso
e pressione dei fluidi e resistenza
e resistenza della terra

emissionen und sozialen Elfen aufzuheben.

passing, lost, practice. Infants V. 1. (lost until 1911)

3. *Leucosia* missouriensis (Praeger) in the
Mississippi River basin, probably.

Afternoon rain with E and 2M: 5:30pm

Ammerbach, wo jenseitig die Städte verkehrt sind. Dagegen
liegen die Städte im Lande gegen die Städte im
Landesinneren verschoben, so dass sie nicht so
weit voneinander entfernt sind. Dagegen sind die
Städte im Lande nach Westen verschoben, so dass sie
die Städte im Lande entlang der Küste aufweisen.

swimming centre

- 2 The work piece is centred so on it rotate exactly around and its centre axis. For the touch the needle of surface gauge on top of the job near the chuck and rotate chuck with hand. It should touch needle of surface gauge on the top of gauge and touch far around the job. If it is displayed to bring it in centre. Loosen the jaws opposite jaw and right the jaws where it touches uniformly.

3 Hold the turning tool in tool post. The tool should be projected out of tool post as little as possible to avoid leverages & approx 20 to 25 mm. The acting edge of tool should coincide with centre and axis rotating MS bar.

4. The larger dia 30.5 mm obtain by first giving a rough cut then finally finishing out which should not be more than 0.75 mm. the direction of feed should be towards head stock.

Step Turning:

- 1 Reduce the dia 30.5 mm to 25.4 mm upto length 35 mm
- 2 Mark 120 mm length from face end and reduce the dia to 27 mm upto 45 mm length from face end upto 120 mm face end.
- 3 Again mark 93 mm length from face end from this mark reduce the dia from 27 mm to 18 mm upto 120 mm length mark.

Facing:

All the faces of different steps are faced with help of parting off tool.

Grooving:

$$\text{Formula } CD = OD - ID$$

Depth $0.64D^3 \times \text{pitch}$

1' bold = 8 TPI

:prinout off

After marking all marks it is time to mark the required grooves. For this we need special tools like grooving tool and parting tool. These tools are used to cut deep grooves in the workpiece. The first step is to mark the required depth of the groove. This is done by marking a point at the required distance from the face end. Then the compound slide is set at the required angle. The compound slide is set at 45 degrees. After marking the required depth, the workpiece is rotated 90 degrees and the required depth is marked again. This process is repeated until all the required grooves are made.

:prinout

Now the workpiece is ready for the next operation. The next operation is threading.

:prinout

As per the drawing the required thread is M10 x 1 mm. The lead of the thread is 1 mm. The pitch of the thread is 1 mm. The diameter of the thread is 10 mm.

- 1 Mark 28 length from face end and groove is made of 7 mm wide grooving tool and dia is reduced from 25.4 to 19.4 mm as calculated above.
- 2 Mark 45 mm and 51 mm length from face end and groove is made with the help of 6 mm grooving tool starting from 45 mm mark.

Japer Turning: The compound slide is set as calculated cycle i.e. 4'6" and taper turning with compound slide.

Threading:

To obtain required thread, set the gear mechanical process for threading operations. When any moving marking of thread chasing of stationary mark then half nut wheel is engaged with the lead screw of thread. Repeat procedure till reqd. depth of thread is obtained.

(68)

Date _____

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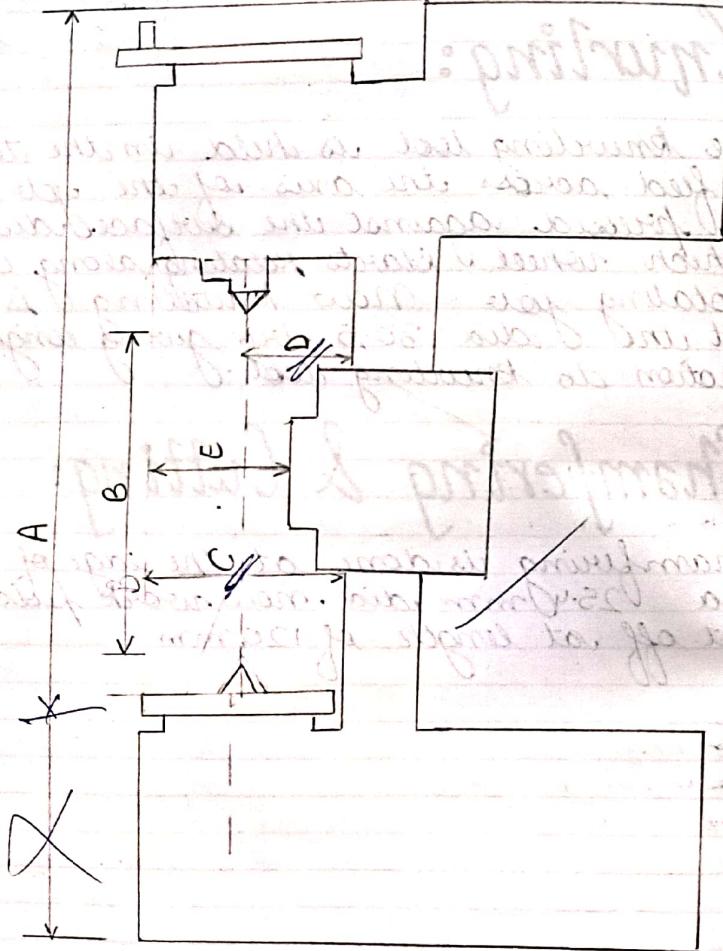
Knurling:

The knurling tool is held in the tool post is feed across the axis of the job and pressed against the surface due to which wheel starts rotating along the rotating job. Now knurling is done at the dia 30.5 by giving longitudinal motion to knurling tool.

Chamfering & Cutting:

Chamfering is done at the edge of 18mm dia 25.4mm dia. now work piece is cut off at length of 120mm.

Teacher's Signature : _____



Lathe Machine

Expt. No. _____

Date 7-03-19

Page No. 17

Specification Of Lathe Machine

The size of lathe is specified by one of following ways:

A → length of bed (Bed length will include Headstock)

B → Distance b/w centres (max. job length that can be held b/w centre)

C → Diameter of work which can be turned b/w (the max. size of job or max. diameter that can be rotated)

D → Height of centres

E → Swing over carriage

~~(a) 5
b) 16~~

~~16
10.4.19~~

Teacher's Signature : _____

Welding & Process

Welding

Welding

Workshop

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12	Job No 1	26-03-19	86-87	
13	Job No 2	27-03-19	88-89	

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Safety Precautions

- 1 Do not look at welding arc without eye shield.
- 2 Protect the arc welding electrodes from moisture.
- 3 Always pick up the hot job with tongs.
- 4 Always remember that your work does not affect anybody.
- 5 Do not wear silky clothes while welding.
- 6 Always use safety goggles while gas welding.
- 7 Always use apron & leather gloves while welding.
- 8 Well wedge the hammer before striking.
- 9 Hold the chisel with pickup tong while cutting.
- 10 There should be an electric shock treatment chart in shop.

Teacher's Signature : _____

Anomalous property

Water & powder is used for the
things we
read about powder are not true.

Special cases do not use powder &
water. Instead water & powder are used.
In case of fire water & powder both
produces bubbles
which sticks to the person from which
it comes.

Water & powder both have
advantages & disadvantages.
Water has a disadvantage that it
can damage clothes & things
but powder has an advantage that
it can remove dirt & marks from clothes
but it can damage clothes.

Advantages of water
1. It is available in every house.
2. It is cheap.

Disadvantages of water
1. It can damage clothes & things.

- 11 Always keep in mind position of fire extinguisher & first aid box.
- 12 In case of fire, the gas cylinder tank should be closed & electric supply should be disconnected.
- 13 Firearm Training
- 14 Miniature model of a building
- 15 Obtaining air
- 16 Flame A
- 17 Flame retardant cloth or cloth
- 18 Flame retardant paint or paint
- 19 Flame retardant fabric or fabric
- 20 Introduction via Welding
- 21 Formation of a bridge & its breaking
- 22 Do not use stiffener in the bridge
- 23 Make the bridge stand on more supports
- 24 Do not make bridge too tight
- 25 Formation of a bridge
- 26 Formation of a bridge with
1. Softening of a piece of soft fabric
2. Formation of a bridge
- 27 Formation of a bridge
- 28 Formation of a bridge
- 29 Formation of a bridge
- 30 Formation of a bridge

List of Experiments

- * Arc welding practice & make a Butt joint
- * Butt joint with help of Oxygenacetylene gas welding.

Types of metal

- 1 Ferrous metal (mild steel, stainless steel & cast iron)
- 2 Non Ferrous metal (Copper, zinc, tin, silver)

Fastening

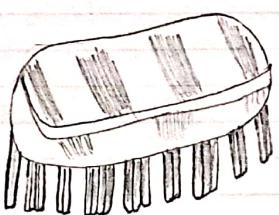
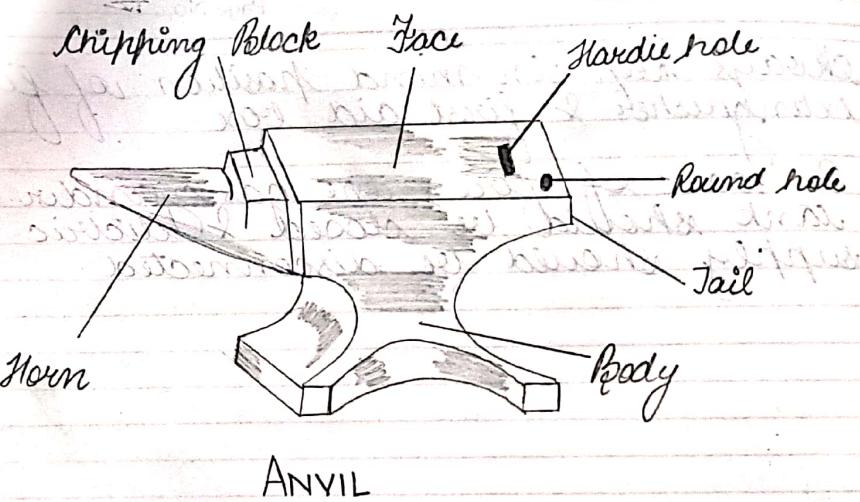
- 1 Temporary (with help of nut & bolt)
- 2 Semi permanent (with help of screws)
- 3 Permanent (with help of welding)

Introduction to Welding:

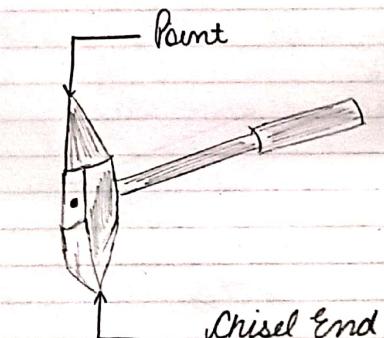
Welding is a process of joining 2 pieces of same or different metals permanently with the help of heat or heat pressure with or without use of filler metal.

Advantages of Welding

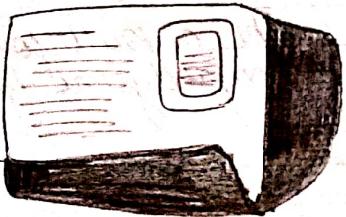
- 1 Welding operation is faster than any process
- 2 Welding is more economical
- 3 Welding joint has more tensile strength as compared to riveting



WIRE BRUSH



CHIPPING HAMMER



FACE SHIELD

Date _____

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Expt. No. _____

- 4 Welding produce 100% efficient joint which is not possible by any other joining process
- 5 Appearance of welding joint is very good
- 6 Welding joint is light in weight
- 7 A large no. of similar & dissimilar metals can be welded easily.

Disadvantages of welding

- 1 Skill person is needed for welding purpose
- 2 Ultra-violet rays & Infrared rays generate during welding process which is harmful for operator's skin & eyes
- 3 Distortion due to high temperature is possible in workspace
- 4 Thermal stresses developed in work piece heat treatment process are req. to relieve thermal stresses
- 5 Welding heat produces metallurgical changes in work piece
- 6 Edge preparation is req. before welding which is time & labor consuming process
- 7 Special jig & fixtures are required for welding

Applications of welding

- 1 Fabrication & Repair work
- 2 Building Construction
- 3 Automobile Industries
- 4 Railway tracks

Teacher's Signature : _____

Expt. No. _____

- 5 Pressure vessels and Tanks
- 6 Aircraft Industries
- 7 Dairy equipments
- 8 Pipeline Industries
- 9 Earth moving equipment.
- 10 Agricultural machinery
- 11 Ship Building Industries

Definition of Filler:

The material rod which provides additional metal for making a weld is known as filler.

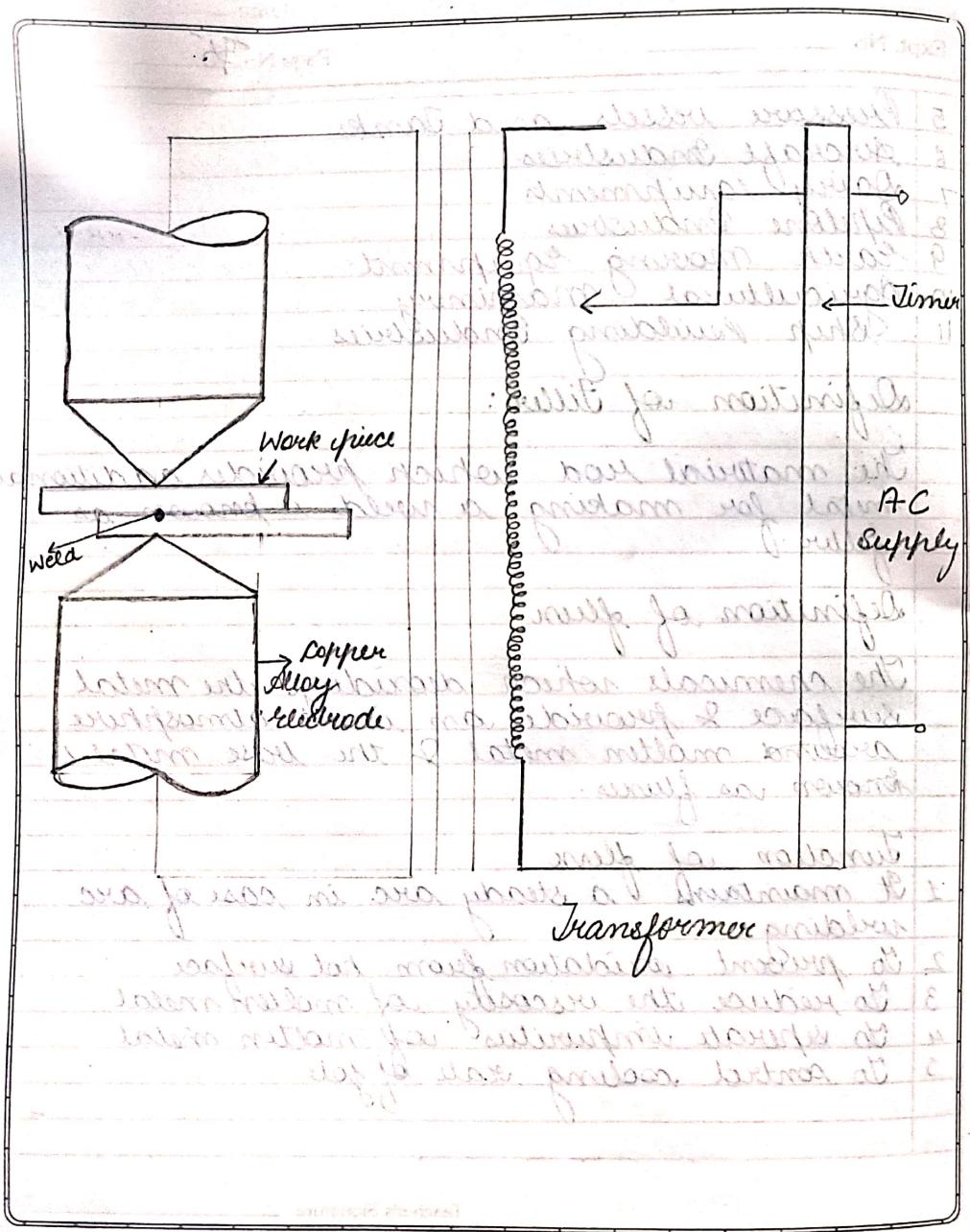
Definition of flux:

The chemicals which deoxidize the metal surface & provide an inert atmosphere around molten metal & the base metal is known as fluxes.

Function of flux

- 1 It maintains a steady arc in case of arc welding
- 2 To prevent oxidation from hot surface
- 3 To reduce the viscosity of molten metal
- 4 To separate impurities of molten metal
- 5 To control cooling rate of job.

Teacher's Signature : _____



cN

Date 20-03-19

Expt. No. _____

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Types of Welding Electrodes

- 1 Metal electrodes
 - 2 Carbon electrodes
- * Consumable
 - Coated (Electric arc welding)
 - Uncoated (MIG)
 - * Non Consumable (TIG, spot & seam welding)

Classification of Welding

1 Homogeneous

It is done by using filler rod. In this, both pieces of base metal & filler metal are of same composition.

2 Autogenous

In this both pieces of base metal are of same composition and welding is done without use of filler metal.

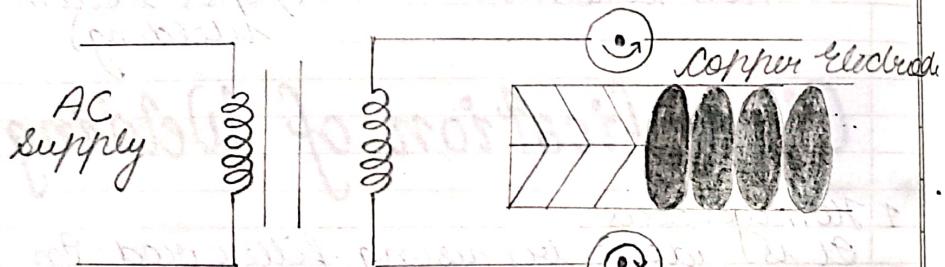
3 Heterogeneous

In this both pieces are of different composition and filler rod is also used and is of different composition.

Teacher's Signature : _____

Method of welding for metal

Welding is a process of joining two or more materials by melting them together with heat.



Welding is a process of joining two or more materials by melting them together with heat. There are two main types of welding: fusion welding and pressure welding. Fusion welding is a process where the materials are melted together to form a bond. Pressure welding is a process where the materials are joined together under pressure without melting. There are many different types of welding processes, such as arc welding, resistance welding, and laser welding. Each type of welding has its own advantages and disadvantages. For example, arc welding is a common method used in construction and manufacturing because it is relatively inexpensive and can be done in various environments. However, it can produce fumes and sparks, which can be dangerous if not properly handled.

Types of Welding

1 Forge, Plastic or Pressure Welding

- * Forge welding
- * Resistance welding
- a) Spot welding
- b) Seam welding

2 Fusion or Non Pressure Welding

a) Electric Arc

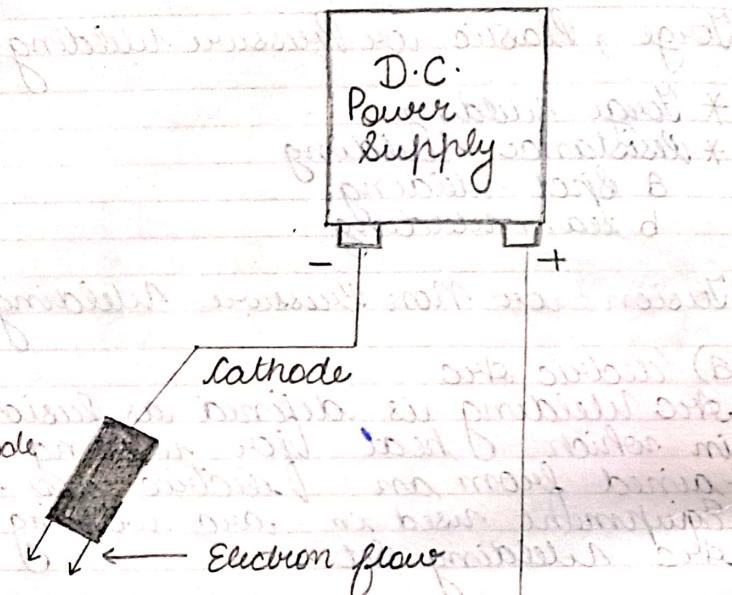
Arc welding is defined as fusion welding in which heat for welding is obtained from an electric arc. Equipment used in arc welding is arc welding set.

b) Electric power for welding

Either AC or DC current can be used for arc welding. For most purposes, DC current is preferred.

DC machine welding get their power from an AC motor or diesel engine which is connected to a DC generator or from solid state rectifier.

principle of arc welding



- Straight polarity welding
- Reverse polarity welding

Straight polarity welding: Welding work piece is made anode and electrode is made cathode.

Reverse polarity welding: Welding work piece is made cathode and electrode is made anode.

(b) MIG welding (Metal Inert gas)

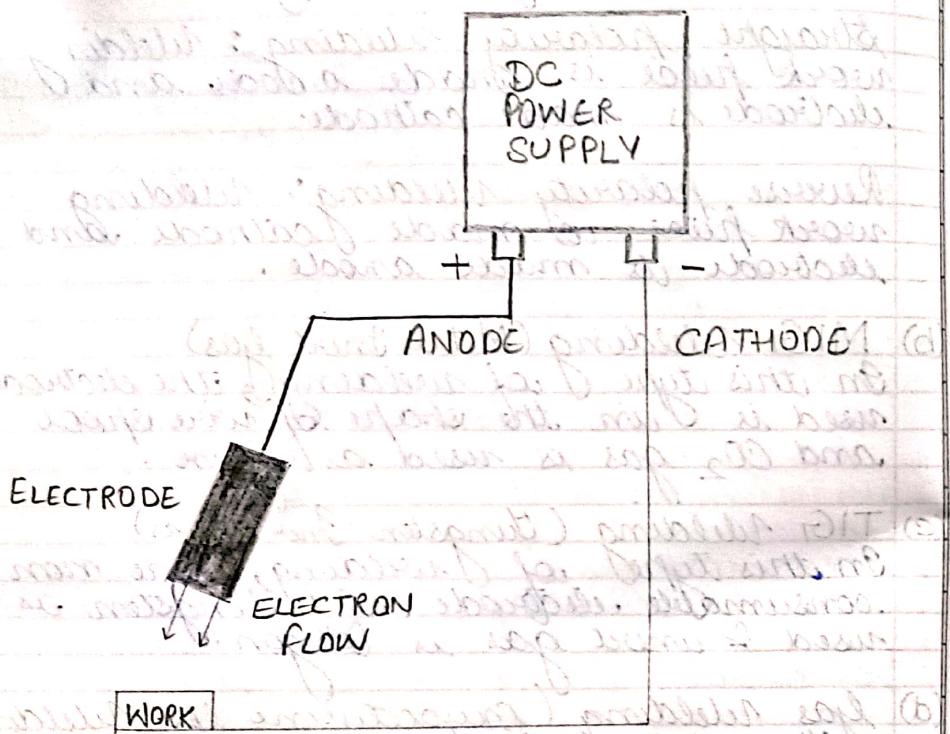
In this type of welding, the electrode used is in the shape of wire spool and CO_2 gas is used as flux.

(c) TIG welding (Tungsten Inert gas)

In this type of welding, if the non consumable electrode of tungsten is used & inert gas is oxygen.

(d) Gas welding (oxyacetylene gas welding)

This type of welding which utilizes the heat generated by an oxyacetylene flame for producing a weld.



Expt. No. _____

Types of Oxyacetylene Gas Welding

1 High or equal pressure system:

In this both Oxygen & Acetylene gases are supplied from high pressure cylinders. The total pressure in Oxygen cylinder is 150 kg/cm^2 & acetylene is $18-20 \text{ kg/cm}^2$. This is used for heavy jobs. The colour of Oxygen cylinder is grey black & of acetylene is maroon.

2 Low pressure system:

In this Oxygen is taken from cylinder & Acetylene gas is prepared from reaction of calcium carbide and water in a reactor called low pressure acetylene gas generator. In this system, the working pressure is 0.07 kg/cm^2 .

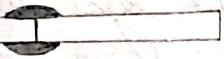
Types of Welding Torches

1 Low pressure:

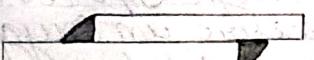
This type of torch is used where the acetylene pressure is low i.e. 0.07 kg/cm^2 . Here with this torch, oxygen as it passes through a small opening in the injector nozzle, draws acetylene into oxygen stream.

Teacher's Signature : _____

Types of Welded joints



Butt joint



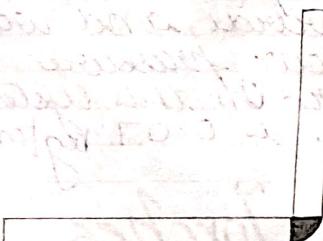
Lap joint



Tee joint



Corner joint



Edge joint

Expt. No. _____

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- 2 Low pressure : This type of torch is used where both oxygen and acetylene are taken from high pressure cylinders.

Types of Gas Welding Torch

Flame:

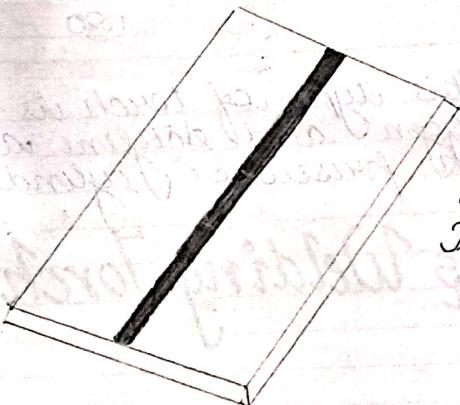
- 1 Oxidising flame : Oxygen gas is more than Acetylene . This is used for cutting metals .
- 2 Carburizing flame : Volume of oxygen is less than Acetylene . This is used for welding non ferrous metals .
- 3 Neutral flame : This flame is produced when oxygen & acetylene are in equal proportions .

Types of Welding Joints

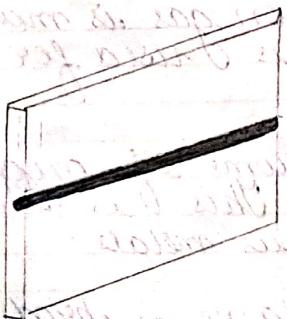
- 1 Butt joints In this type of joint edges are needed in same place. Both each other V or U shape

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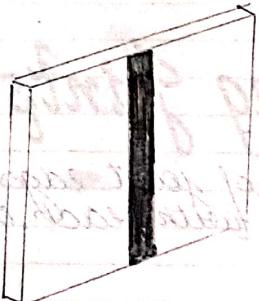
WELDING POSITION



Flat Position



Horizontal Position



Vertical Position

Date 20-03-19

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2 Lap Joint :

This type of joint is used in two overlapping plates so that corner of each plate is joined with surface of other plate.

3 Tee joint

When two surfaces are to be welded at right angles.

4 Corner joint

In this, the edges of two sheets are joined and their surfaces are kept at right angles.

5 Edge joint

In this two parallel plates are welded

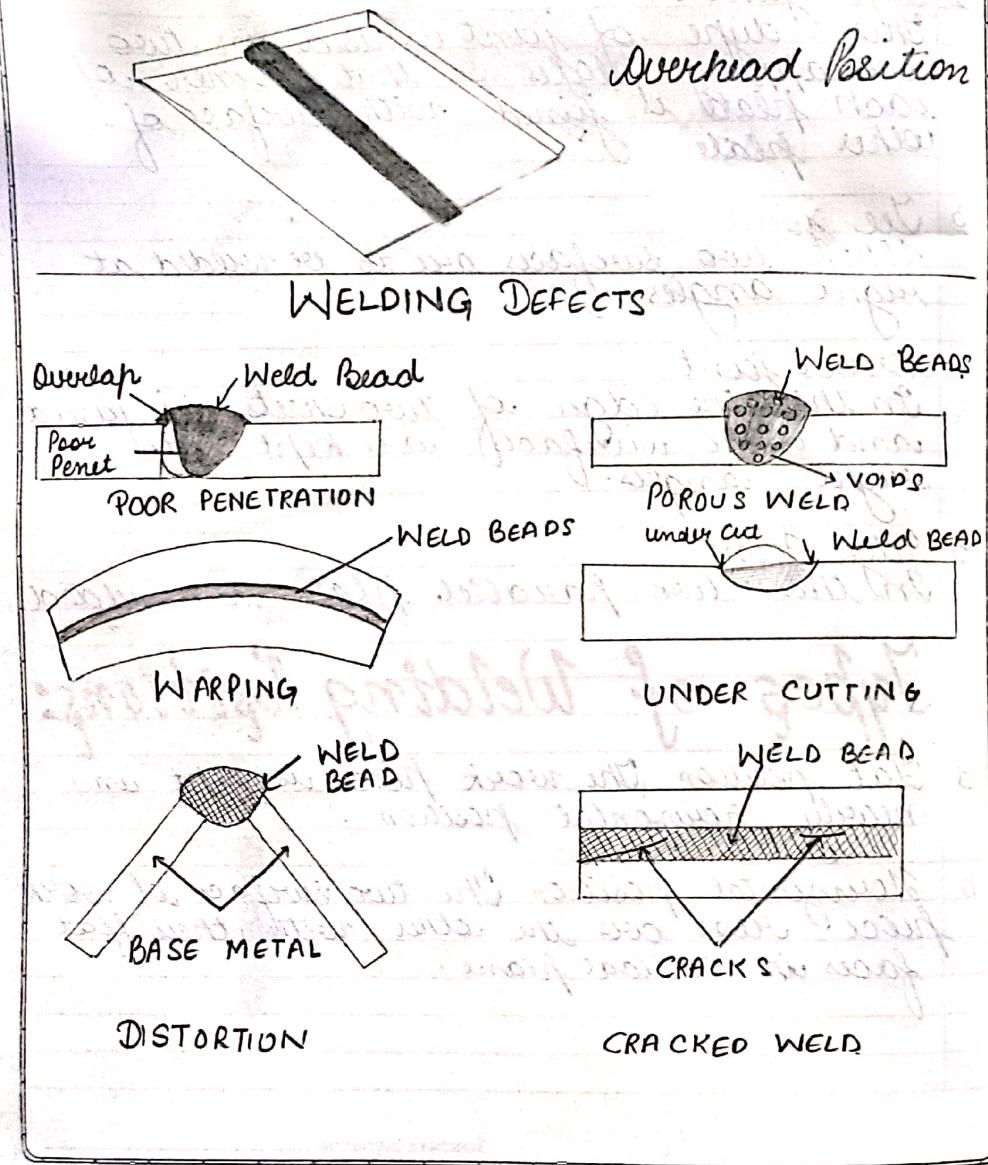
Types of Welding Positions:

a) Flat position The work piece is kept in nearly horizontal position.

b) Horizontal position The two surfaces of work piece rest over the instru with their flat faces in vertical plane.

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Expt. No. _____



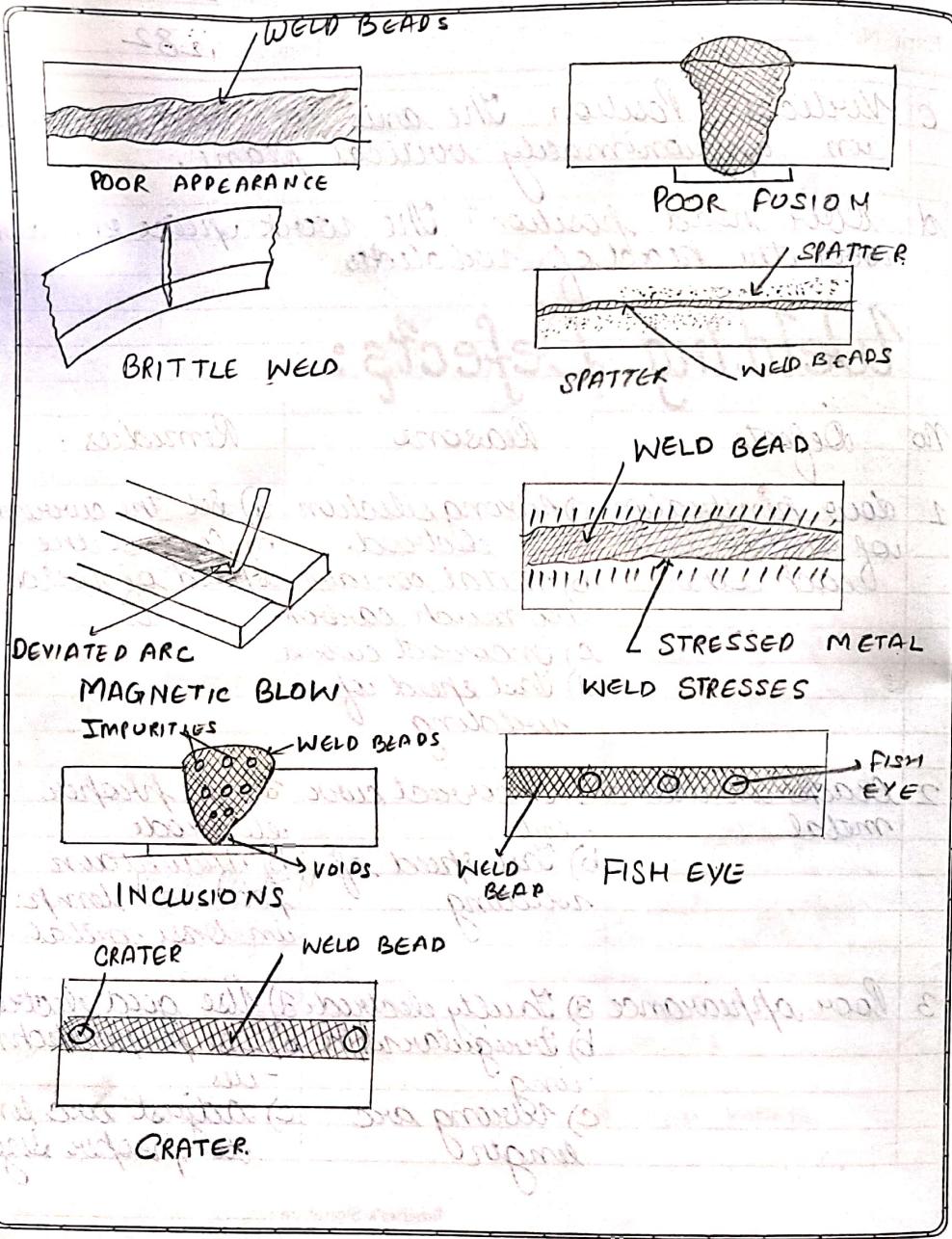
c) Vertical Position The axis of weld remains in approximately vertical plane.

d) Over head position: The work piece remains over the head of welder.

Welding Defects:

S.No	Defects	Reasons	Remedies
1	LOW PENETRATION	a) Wrong selection of metal unto b) Reach other	a) Set the current of electrode b) Control the speed of welding
2	Cracks in weld	a) Incorrect curr -ent b) fast speed of welding	a) Use proper electrode b) Maintain low heat temp. in base metal
3	Poor appearance	a) Faulty electrode b) Irregular welding c) Strong arc length	a) Use good electrode b) use proper technique c) Adjust arc length to proper size

Teacher's Signature : _____



Expt. No. _____

4 Inclusions

- a) dirty base metal
- b) improper removal of slag low sulphur content

5 Poor fusion

- a) wrong current setting
- b) rubbing down the electrode & work piece
- a) adjust the current setting
- b) Adjust length of electrode to proper size.

6 Blow holes

- a) wrong arc length
- b) old, fresh & moisten
- b) Old electrode free electrode.

7 Wrapping

- a) uneven heating
- b) over heating
- a) Use single lead of welding
- b) avoid overheating

8 Scattering of welding

- a) high current
- b) long arc
- a) Adjust current setting
- b) Adjust arc length

Welding, Brazing, Soldering

Welding

- 1 In this fusion
is retained by
heat & /or press
-ure

- 2 The strength of
joint is highest

- 3 The filler material
may or may
not be used

- 4 The joint strength
may be equal to
or even greater
than strength of
base metal

- 5 The composition
of filler metal
is same as that
of base metal

Soldering

- The joint is obtain
-ed by means of
filler material
whose mp is
less than 450°C

- This joint is
weakest

- The filler material
is essential

- It depends upon
the adhesive
qualities of filler
material

- Essentially filler
metals and of
base metal

Brazing

- The joint is obtain
-ed by means of
filler material
whose mp is
above 450°C

- It is stronger than
soldering
& weak than welding

- The filler material
is essential

- It depends upon
the adhesive
qualities of filler
material

- The filler metal
are alloys of
copper

Welding, brazing, soldering

Welding: A joining method in which metal parts are joined by melting and solidifying of metal at the joint. It is a permanent joint.

Brazing: A joining method in which metal parts are joined by heating the joint area to a temperature slightly above the melting point of the base metal. The joint is made by melting a filler metal which has a lower melting point than the base metal. The filler metal is usually a non-ferrous metal like tin, lead, or zinc.

Soldering: A joining method in which metal parts are joined by heating the joint area to a temperature below the melting point of the base metal. The joint is made by melting a filler metal which has a lower melting point than the base metal. The filler metal is usually a non-ferrous metal like tin, lead, or zinc.

- | | | | |
|---|-----------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------|
| 6 | Welded joints can withstand high-temperature service. | These are not suitable for high-temperature service. | These are not suitable for high-temperature service. |
| 7 | The process can't join dissimilar metal. | The process can join dissimilar metal. | This process can join dissimilar metal. |
| 8 | The parent metal is heated to melting temp. so welding is likely to cause damage to its properties. | Heating of parent metal does not cause any change. | Heating of parent metal is negligible to cause any change. |
| 9 | It has wide applications in construction & maintenance of boats. | It is widely used in joining small assemblies. | It is used for joining electrical parts, radiators etc. |

Date 25-03-19

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Job No. 1 : To make a Butt joint with the help of arc welding

Material : Mild Steel plate

Size : 3" x 1 $\frac{1}{2}$ " x $\frac{1}{4}$ " - 2 pcs

Tools : Smith Scale, cold flat chisel, Hand hammer, Chipping Hammer, Sledge Hammer, Anvil, Tong, Eye Shield, Steel Wire Brush

Apparatus : Arc welding set or set down transformer, Working Table.

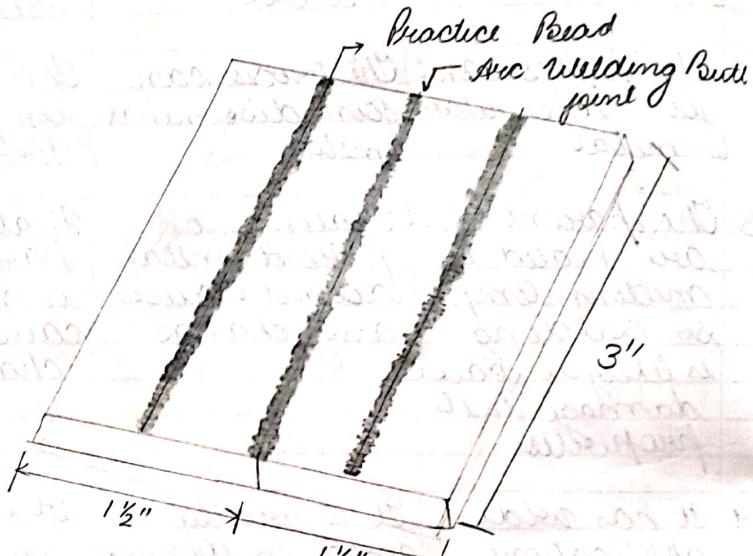
Filler : Flux coated electrode of 3.15 mm

Current Setting : 100 amp (with 60v AC output)

Procedure :

- 1 Select the material from a long MS strip $\frac{7}{4}$
- 2 Mark on the strip the given size 2 pcs with help of Smith scale.
- 3 Cut the job piece from a long strip with the help of cold flat chisel
- 4 Hold the job piece from table with long & place on face of anvil them,

Teacher's Signature : _____



ARC WELDING JOINT

straighten it with hand hammer.

5 Locate both job pieces on working table

6 Lock the job at bottom of the both ends with arc welding

7 Keep electrode & job gap equal to electrode diameter

8 Make a practice lead on one side of job

9 Make 3 practice leads on job

10 Finally weld the job in centre or making butt joint one by one

11 Remove the flux with help of chipping hammer & clean it with steel wire brush

Precautions:

1 Never look at welding arc without eye shield

2 Always wear flexible glove & leather apron

3 Always use tongs to hold hot jobs.

Date 26-03-19

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Job No 2: To make a butt joint with gas welding

Tools: Smith Scale, cold flat Chisel, Hand Hammer, Anvil, Tong, Safety Goggles

Apparatus: Low pressure Oxyacetylene gas welding set.

Job material: Mild Steel Flat

Job size: 3" x 1 $\frac{1}{2}$ " x $\frac{1}{8}$ " - 2 pcs

Filler material: Copper Coated Mild Steel Rod

Procedure: 1 Select the mild steel flat material from long strip

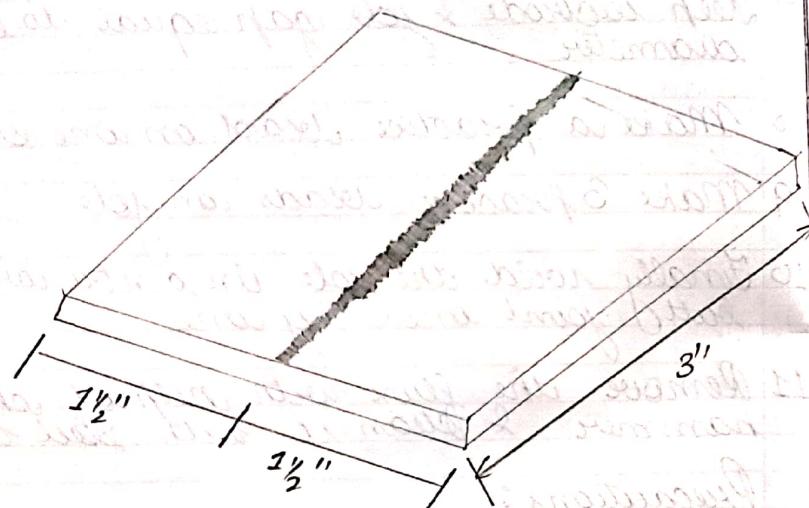
2 Mark on strip the given size & 2 pcs

3 Cut the job piece from a long strip with help of cold flat chisel, hand hammer

4 Hold the cut job piece with tong & piece on face of anvil then straighten with hand hammer

5 Locate both job pieces on working table

Teacher's Signature: _____



Gas Welding Butt joint

Expt. No. _____

- 6 Light the gas torch & adjust required flame & lock both job pieces
- 7 Re straighten the job with help of hand hammer
- 8 Weld the locked job, make a butt joint on both sides one by one with CC Rod & controlled heat
- 9 Clean the job with help of Wire Brush

- Precautions :
- 1 Handle oxygen cylinder & acetylene tank carefully
 - 2 Do not lubricate the adjusting screw/knobs with oil
 - 3 Always check leakage of gas with soap solution

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Date _____

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Syllabus

- 1) To wire up a circuit of one lamp by one switch (CTS or Batten wiring)
- 2) To wire up circuit of one lamp and one 3 pin wall socket by CTS Batten wiring
- 3) To make a straight joint of PVC
- 4) To make a Tee joint of PVC or VLR wire
- 5) To solder joints
- 6) Practice of soldering on PCB using electronic components.

Date 03-04-19

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Safety Precautions

1. Donot forget to pull off the main switch when you are working on supply line
2. always be careful
3. You should not energise any conductor unless you are sure that all is clear & none is working
4. You should not tamper with unnecessarily live electrical gear
5. Before replacing broken fuses always put the main switch off
6. All machine should be properly & good earthed
7. live wires should always be controlled through kit-kat fuses
8. Donot use a splic as a hammer
9. Donot put a sharp edge tool in pocket
10. If you want to hand over any sharp tool to someone else. give it from handle side
11. Never use any tools like file, knife without handle.
12. In rainy season apply grease on tools
13. In case of fire, donot throw water on live conductor & equipment as it is dangerous
14. In case of fire only CO₂ extinguisher is used
15. Before starting the work on pole you must use safety belt & ladder

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Expt. No. _____

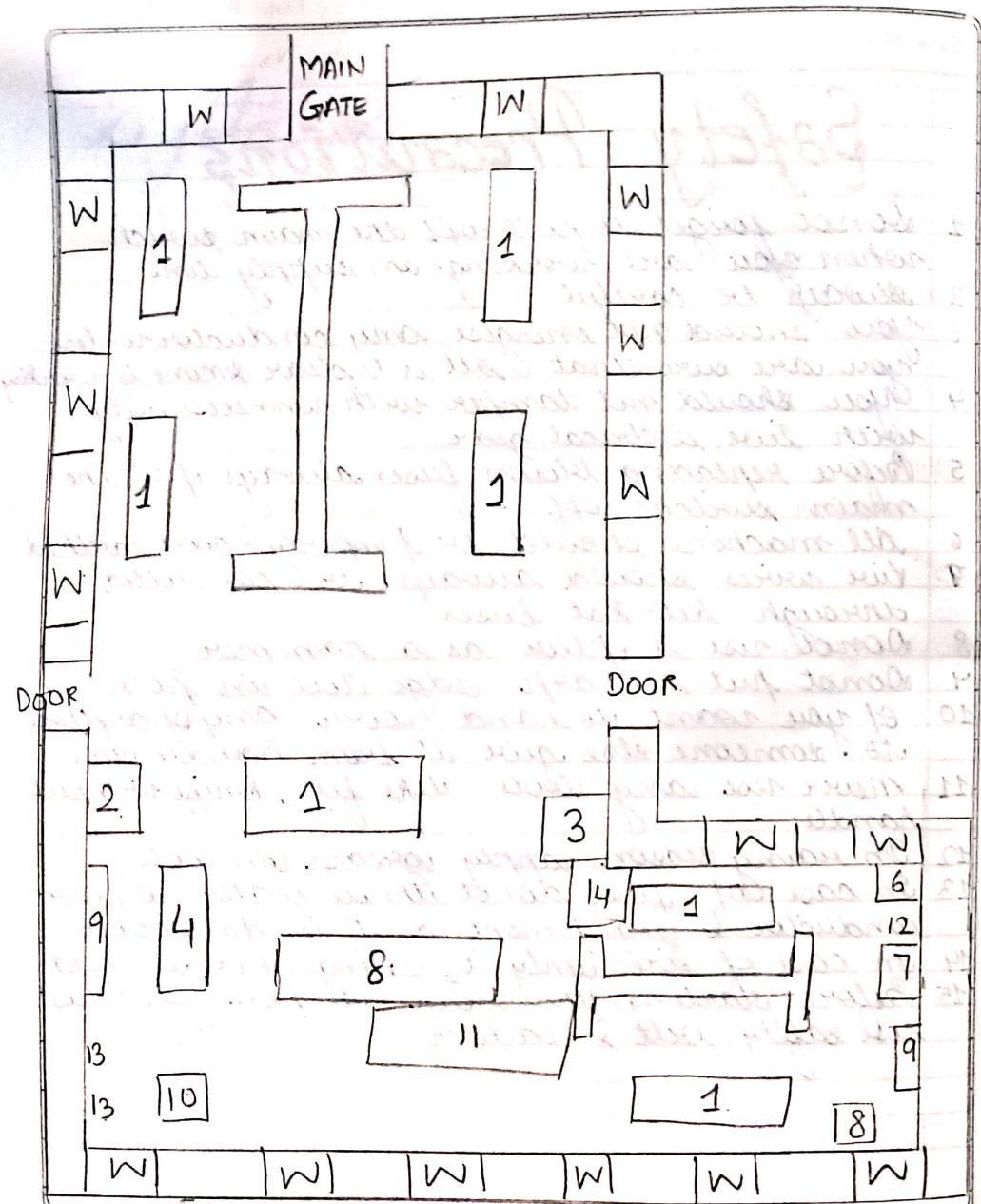
Layout:

1. Working Table
2. Bench Drilling MIC
3. Bench Grinder
4. Tool Rack
5. Wiring Board
6. Wooden Admirah
7. Steel Admirah
8. Office Table
9. Black Board
10. Room Cooler
11. Transform Coil
12. Switch Board
13. Display Board
14. Domestic wdg MLC

Introduction: Electricity is an essential need to our daily life. It is widely used for domestic as well as industrial purposes. So it is necessary for engineering students to know about electric work. In electric shop, knowledge is given about the electricity, field of its application, electrical instruments, domestic & industrial wiring, electrical goods used, symbols and precaution to be kept in mind.

Types of wires & cables: - Various electrical materials used for domestic and industrial purposes are described below.

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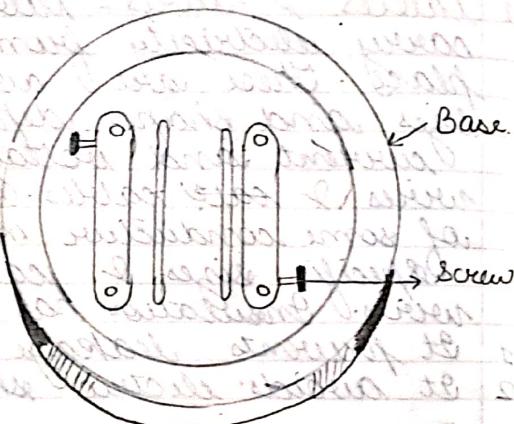
- 1 Cables & wires : Cables & wires are used to carry electricity from one place to another place. These are available in different sizes and shapes depending upon the current and voltage flowing through wires & cables. Wires are made up of some conductor material drawn into specific sizes & cables are insulated wires. Insulation has following functions
- 1 It prevents leakage of current
 - 2 It avoids electric shock.

Various Types of Electric Wires

- (I) PVC wires (II) CTS wires / TRS wires
 - (III) Lead Sheathed wires (IV) Weather proof wires
 - (V) VIR wires.
- (I) PVC wires : These are covered with insulation of poly vinyl chloride. PVC wires are generally used for batten wiring and conduct wiring.
- (II) CTS wires : VIR wires insulated with one more covering of tough rubber are known as CTS wires. These are used for high voltage. These wires may be of single core, double core or three core.



FLUSH SWITCH



CIRCULAR FUSE

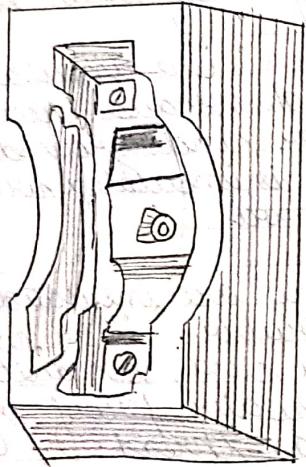
Expt. No. _____

- (III) Lead Sheathed wire : These wires are covered from outside with lead & lead alloy. These wires are used in snowfall area. Lead improves the strength of outer layer.
- (IV) Weather Proof wires : The insulation of such wires is very high because these are generally used for outdoor or underground work. The conductive wire is insulated with rubber layer. It is insulated well.
- (V) V.I.R wires : These wires are insulated with vulcanised Indian rubber. These wires are insulated (used) for plant, conduit wiring. Wires are made water proof by providing a covering with wax thread.

Switches : Switch is used to connect or disconnect electric circuit. It is connected in phase wire line. Various types are :

- (I) Surface switches : These switches were used in old days. The size of surface switch is big & these are fixed on wooden board. Material is Bakelite.
- (II) Flush switches : These switches do not project sideways. Major portion of switch is fixed onto mic board. These are made of Bakelite.

Teacher's Signature : _____



KITKAT FUSE

FUSE : A device in which fusible wire is used to connect electric circuit. When there is over loading of current, it melts & the circuit is broken. Generally thin Cu wires are used as fuse wires. Other material can be of tin or aluminium. Various types are:

- (I) **Kitkat fuse :** It is made of two parts (main body & cover). The line connections are given into the main-body & fuse wire is carried on metallic strips in fuse cover. Body & cover are made from porcelain. These are specified depending upon current flowing through it.
- (II) **Circular fuse :** It has circular base & a cover. Line terminal & fuse wire is fitted on base. The material of base & cover is either porcelain or Bakelite.
- (III) **Cartridge fuse :** In this fuse wire is enclosed permanently inside a small glass tube. In case the fuse wire melts due to overload or some faulty wire tube assembly is replaced.
- (IV) **HRC Wires :** This wire is similar to cartridge fuses. The fuse wire of HRC fuse can carry heavy current its small size.

Expt. No. _____

Ceiling Rows: It is used to connect ceiling fan, fluorescent tubes etc. to main electrical circuit. A flexible wire is used to carry current from ceiling row to load point. It is made of Bakelite supply terminals. Terminals are fitted into hole base. A hole is provided in cover to take out the flexible wires to load point.

Sockets Outlets: Electrical devices are connected to electric supply through socket outlets.

1 **Two pin socket:** In this two holes are made for phase & neutral connection.

2 **Three pin socket:** In this extra holes are made for earth connections.

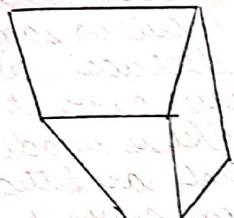
Lamp holders: These are used to support bulb & connect them to supply terminal inside holders. These holders are made up of bakelite. The holders are made of bakelite with copper top.

(i) **Batten holder:** Such type of holders are fitted on walls or vertical partitions. These are fixed on gypsum sheets.

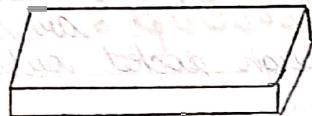
(ii) **Pendant holder:** These are used to hold the

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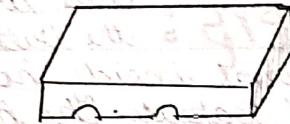
Expt. No. _____



GUTTIE



BATTEN



CLEAT

bulb suspended from ceiling. A chain & a flexible wire is used to connect the holder with ceiling wire.

- (III) Angle holder & Angle holders are used to hold the bulb at an angle to vertical walls.
- (IV) Bracket holder: When bulb is to be fixed at some distance from wall, bracket holders are used.
- (V) Swivel holder: In this direction of bulb can be changed. A socket & ball joint is provided in such type of lamp holder.

Gutties: It is used for fixing batten boards or lamp holders. These are made of wood. Round & square gutties are commonly used.

Battens: It is used for wiring of circuits for domestic or industrial purposes. These are available in 2 sizes i.e. $1\frac{1}{2}'' \times 1\frac{1}{2}''$ or $3'' \times 1\frac{1}{2}''$. It is made of wood & wires are fitted with help of clips.

Cleats: It is made of 2 parts: base & cap. These are 2 and 3 grooves made in base for accommodating the wires & cap is placed over it.

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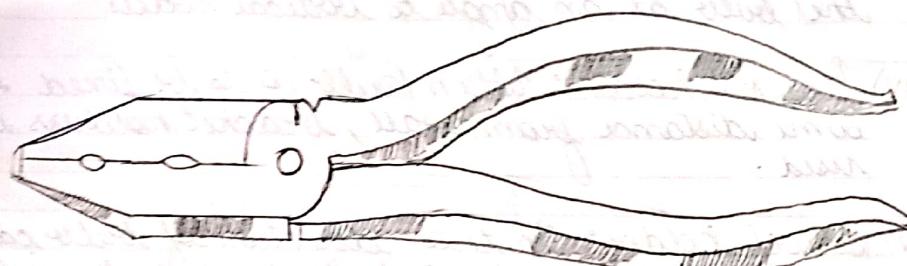
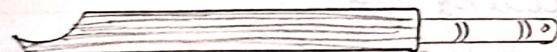
Tools Used :-

- 1 **Knife**: Knife is a cutting tool used to remove insulation from wires. While using knife it should not cut inner wire.
- 2 **Plier**: It is used to cut the wires, twisting wires, loosening of nuts, removing insulation. These are of 3 types
 - (i) Flat nose plier (ii) Long nose plier (iii) Side cutting plier.
- 3 **Screw Driver**: It consists of handle and blade. Handle is made of plastic or wood and blade of steel.
- 4 **Poker**: It is sharp edge tool used to make holes in wood.
- 5 **Claw Hammer**: It is used to strike nail & screw to pull nails or screw out of wood.
- 6 **Mallet**: It is wooden hammer. It is either circular or rectangular.
- 7 **Hacksaw**: It is used to cut pipes, strips.
- 8 **Hand drill**: It is used for drilling holes in wooden boards. It is driven by hand.

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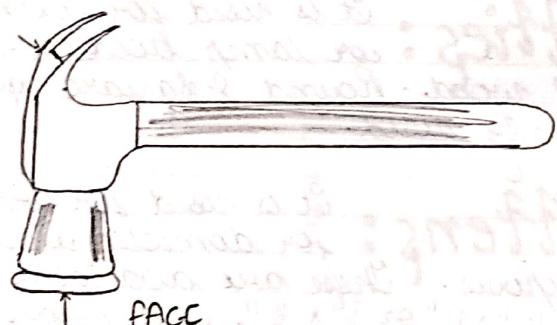
Knife, Flat nose Plier, Screw Driver,

Claw hammer, Hacksaw, Hand drill, Mallet

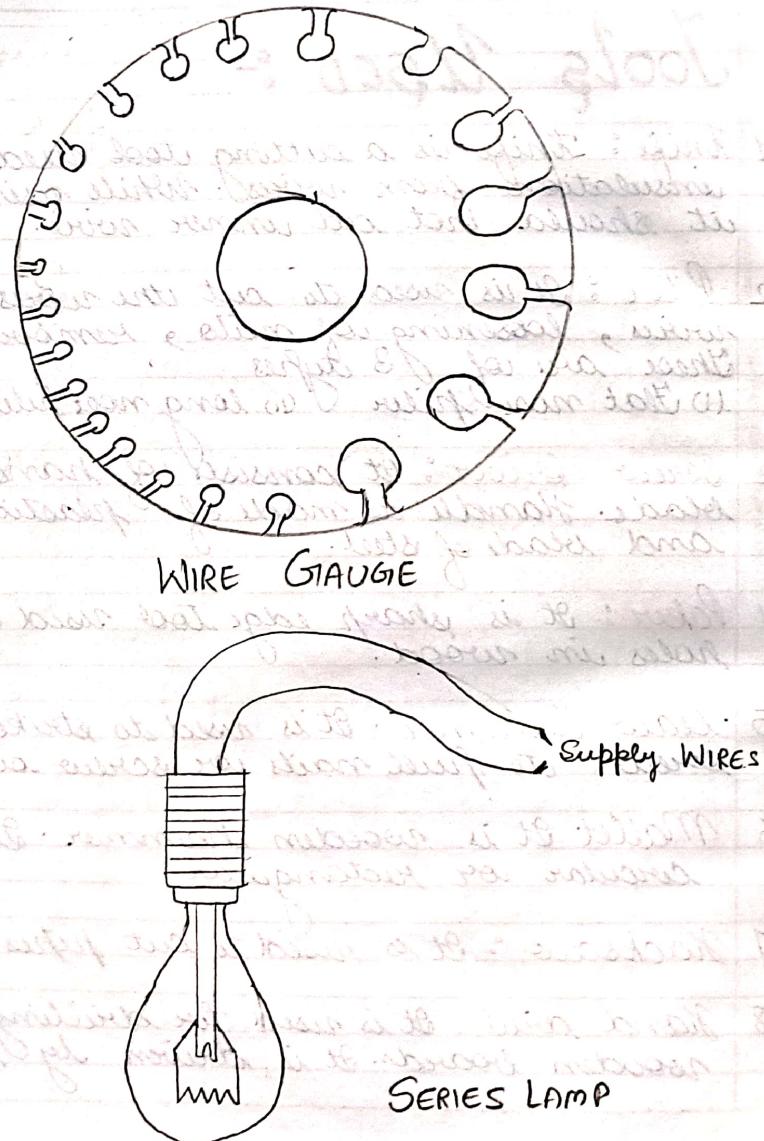


FLAT NOSE PLIER

CLAW FACE



CLAW HAMMER



- 9 Drilling machine: When it is difficult to make holes with hand drill we use this
- 10 Wire gauge: It is used to check size of electrical wire. It consists of steel disc having slots & holes in circumference.
- 11 Test pen: It is used to check supply and loosening or tightening of nuts. It consists of bulb which shows whether current is flowing or not
- 12 Series lamp: It is test lamp. It is used to make different lists and check of electrical terminal. It consists of bulb and 2 wires.

Types of Wiring:-

- 1 Cleat wiring: Cleat wiring is used for temporary purposes. Wooden or plastic are used at small distance.
- Advantages:** 1) It is quick & economical system.
 (2) Less skill is required.
- Disadvantages:** (1) Risk of mechanical injuries
 (2) Not applicable in damp season.

2) TRS or CTS wiring : The wires are covered with tough rubber and are fixed on wooden batten. It is wooden gutties are unsected where the chances of damage is more.

Advantages : life of wire is more
2) easy to work

Disadvantages : (1) Cannot be use for out-door work
(2) Cannot withstand heat.

3) Casing wiring : Wires are placed in grooves provided on casing. It is covered with strip box called strip capping. It is fixed on walls.

Advantages : 1) More durable
2) Easy installations

Disadvantages : 1) Skilled labour is required
2) wastage of strip is more.

4) Conduit wiring : In this VLR wires are used. These are enclosed in conduit pipes for mechanical protection. Tree risk are also avoided.

Advantages: (1) More life
(2) System is moisture proof

Disadvantages: (1) It is costly system
(2) Skilled workmen are required.

5) Lead sheathed wiring : The wires are fixed by means of wooden baton . It is enclosed in lead covering .

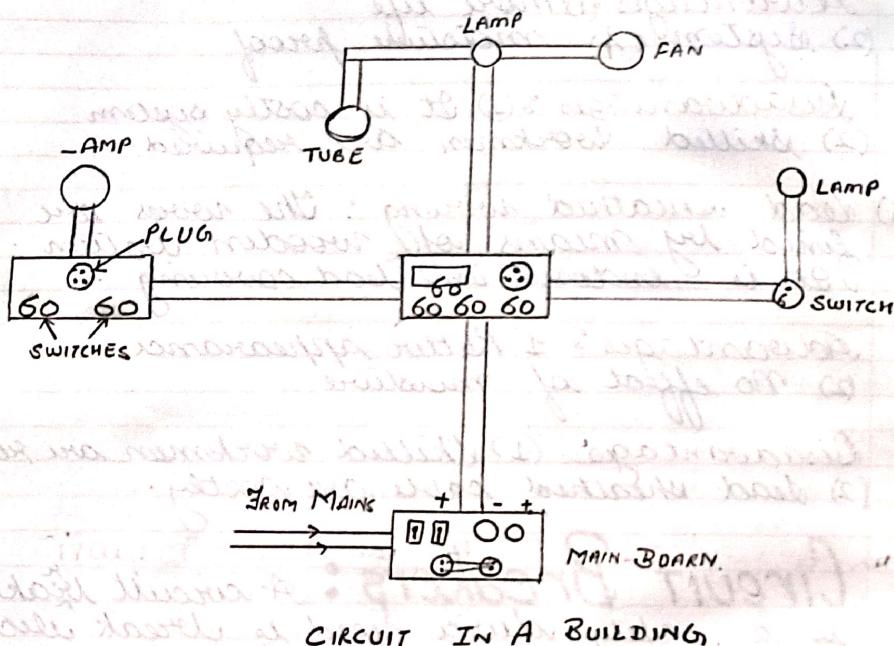
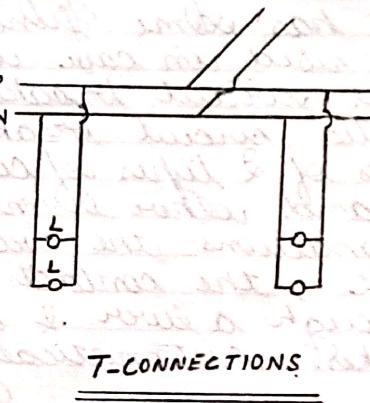
Advantages: 1 Better appearance
(2) No effect of moisture

Disadvantages: (1) Skilled workmen are required
(2) Lead sheathed cable are costly .

Circuit Breakers: A circuit breaker is a safety device used to break electric circuit in case of any fault in wiring system . It has some function as fuse but it is used in case of high voltage.

- 1 Manual circuit breaker
- 2 Automatic circuit breaker

All consists of 2 types of contact points . One is fixed and other is movable . Under normal conditions the circuit remains closed . In manual , the contacts are separated by hand through a lever & in automatic , it is broken automatically .

T-CONNECTIONS

Protective Relays: It is used to find fault in any circuit. The circuit conditions are measured constantly. The faulty condition is detected by relay and circuit is protected from any loss. It is fitted in main circuit and circuit breaker.

Types of Circuits:

1. On basis of nature of current:
 - (i) AC circuit: The circuit which carry an alternating current.
 - (ii) DC circuit: The circuit which carry direct current.
2. According to completion of path:
 - (i) Open circuit: When there is some discontinuity in flow of electric current and e- are not able to complete there path.
 - (ii) Closed circuit: The circuit in which electric current completes the path regularly.
 - (iii) Short circuit: The phase wire & neutral wire come in direct contact with each other.

House Wiring: From poles, the electricity is carried to meter and main board. A phase wire and a neutral wire come to energy meter. On main board a main

switch and fuses are installed. From there, the energy is delivered to sub boards. Sub boards supply power to domestic appliances.

Types of House Wiring:

- 1) Tree connection: (Diagram)
- 2) Looping in connection: In this two leads are brought back from switch & lamp holder terminals.

Job No-1 To wire up a circuit of one lamp using one switch (CTS or Batten wiring)

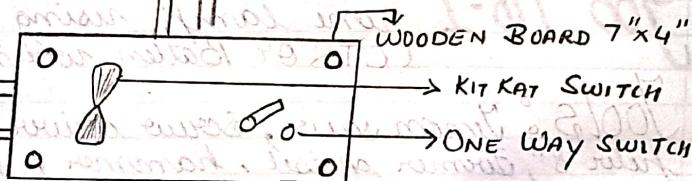
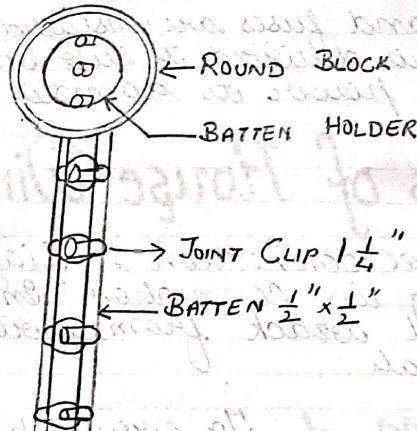
Tools: Jmon saw, screw driver 8", Combination plier 8", Hammer, knife, Plier, Steel foot rule

MATERIAL: Wooden board, kit-kat fuse, One way switch, wooden batten, Round block, Batten holder, Nails, PVC wire, wooden screw 20mm, 30mm, 50mm.

Procedure:

- (1) Cut 2 wooden batten pieces (10", 8")
- (2) give slope cutting on both ends
- (3) Fix joint clips on it and with help of nails.
- (4) Fix batten piece on wiring board with 30mm screw.

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FITTING DIAGRAM

- (5) Cut the wires according to required length
- (6) Make holes in round block with machine
- (7) Cross wires through round block holes and fix with 50 mm screw
- (8) Connect wires on wooden to batten holder and fix with 20 mm screw
- (9) Fix accessories on board & make internal connection
- (10) Make connections to wiring board & fix with 50mm screw.
- (11) Test with wiring meter.

PRECAUTIONS

- (1) Always control phase wire through kit-kat fuse and switch
- (2) All connections should be tight and accessories should be well fitted.
- (3) Use proper tools
- (4) All naked joints should be properly taped

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