SYLLABUS

Subject: Workshop Practice **Subject Code: MECH1011**

Contact: 1l + 3p

Credit: 3

Job No	Theory needs to be covered	Job Title	Contact Hours
1	Workshop definition, various shops in a typical workshop, Carpentry, Fitting, Foundry; Sheet Metal Shop, Welding and Brazing Shop, Machine Shop , Forging & Blacksmithy, Safety precautions to be followed in a workshop, Familiarization of Various safety devices and their uses.	General awareness of a typical workshop.	4(Four)
2	Market forms of converted Timber e.g. log, balk, plank, batten, beam ,Types of Wood, Hard Wood, Soft Wood, particle board; Seasoning of wood, Natural seasoning, Artificial seasoning, Carpentry Tools- Marking Tools, Cutting Tools, Planning Tools, Boring Tools, Striking Tools , Holding & Misc. Tools, Carpentry Processes (marking, sawing, planning, chiseling, boring, grooving, joining etc.), Safety precautions in Carpentry Shop.	Making of a wooden pattern.	4 (Four)
3	Work Bench, Fitting Tools (Bench Vice, Chisel, Hammer, Different types of Files, (Rough, Bastard, Second Cut, Half Round, Triangular File),Saw(Hack saw etc.), Scriber, Punch, Try Square, Angle Plate, caliper (outside & inside), Universal Surface Gauge, Centre Punch, Prick Punch, Drill (Flat, straight fluted, taper shank twist drill). Fitting Operations, Filing, Marking, Drilling, Tapping (Rougher, Intermediate, Finisher taps), Tap Drill size (D=T-2d), Sawing, Dyeing, Safety precautions in Fitting Shop.	Making of a matched profile form MS plate.	4 (Four)
4	Thread standards and thread classifications, Internal Thread, External Thread, Thread Nomenclature (Major dia, Minor dia, Pitch dia, pitch, Lead, TPI, Metric, BSP , Nominal size), Specifications of threaded fasteners (in Metric System). Safety precautions in Dyeing and Tapping.	Making of an internal and external thread.	4 (Four)
5	Mould making, Preparation of sand, (silica, clay, moisture, and misc items and their functions), Properties of a good sand mould, General procedure for making a good sand mould, Different tools used for preparation of a mould, Explanation of various terms , Cope and Drag Box, Runner, Riser, Gating and its utility, Parting sand, Vent holes.	Making of a green sand mould using the pattern made earlier.	4 (Four)
6	Metal melting furnaces: Ladles, Using of Tongs, Molten metal pouring procedure, Safety precautions in pouring molten metal in a mould.	Demonstration of metal melting and casting.	4 (Four)

7	Machining and common machining operations , Lathe M/c and its specifications, Head stock, Tailstock, Chuck-Self centering chuck , 4 jaw chuck, Bed, Carriage, Feed mechanism, Screw cutting mechanism, various lathe operations like turning, facing, grooving, chamfering, taper turning ,Thread cutting, Knurling, Parting, Cutting speed, Feed, Depth of cut , Different types of cutting tools-Safety precautions in a machine shop	Making of a stepped pin in centre lathe.	8 (Eight)
8	Description of a Shaping machine, Base , Column, Saddle, Clapper box, Quick return mechanism, Feed Mechanism, Table, Rotation of table, Adjustment of stroke length, Adjustment of starting point of cut. Safety Precautions while working in Shaping Machine.	Making of square prism from a round shaft	4 (Four)
9	Description of a milling machine, Specification of a Milling machine, Types of Milling-Up Milling, Down Milling, Vertical Milling Machine, Horizontal Milling Machine, Safety precautions while working in Milling Machine.	Making of square prism from a round shaft	4 (Four)
10	Welding, Weldability, Types of Welding, MMAW, Gas Welding, Electrode , Functions of Flux, Equipment for MMAW, Different types of Flames in Gas Welding and Gas Cutting (Neutral-Oxidizing-Reducing Flames), Different types of welding joints, AC Welding , DC Welding; Safety precautions in Welding Shop.	Arc Welding practice and making of a welded joint	4 (Four)
11	Specification of sheet metal, SWG vs. mm, HR sheet, CR sheet, GI Sheet, Stainless Steel Sheet, Aluminum sheets, Tin Plates, Sheet metal working Tools, Micrometer, Chisels, Punches, Hammers, Mallets, Hand Shear or Snippets, Various sheet metal forming operations, Shearing, Marking, Punching, Drilling, Bending, Drawing, Brazing, Safety precautions in Sheet Metal Working Shop.	Sheet Metal forming & Brazing	4 (Four)

Recommended books:-

1. Elements of Workshop Technology (Vol- I and II)- Hajra Choudhury, Media Promoter & Publishers Privet Limited.
2. Workshop Technology (Vol- I and II) – Chapman , Viva Books Privet Limited.
3. Workshop Technology – R.S Khurmi, J.K Gupta , S Chand & Company Ltd

HERITAGE INSTITUTE OF TECHNOLOGY

Department Of Mechanical Engineering

Subject: Workshop Practice **Subject Code: MECH 1011**

Sl. No.	Name of Shop	Theoretical Topics that need be covered in the class
1.	Carpentry Shop	Market forms of converted Timber e.g. log, balk, plank, batten, beam -Types of Wood-Hard Wood-Soft Wood-Seasoning of wood-Natural seasoning-Artificial seasoning-Carpentry Tools-Marking Tools-Cutting Tools-Planning Tools-Boring Tools-Striking Tools-Holding &Misc. Tools-Carpentry Processes (marking, sawing, planning, Chiseling, boring, grooving etc.) Safety precautions in Carpentry Shop.
2.	Fitting Shop	Work Bench- Fitting Tools (Bench Vice-Chisel-Hammer-Different types of Files-(Rough-Bastard-Second Cut-Half Round-Triangular File)-Saw (Hack saw etc.)-Scriber-Punch-Try Square-Angle Plate-caliper (outside &Inside)-Universal Surface Gauge-Centre Punch-Prick Punch-Drill (Flat-straight fluted taper shank-Twist Drill). Fitting Operations-Marking-Drilling-Tapping(Rougher-Intermediate-Finisher taps)-Tap Drill size (D=T-2d)-Sawing-Dyeing-Internal Thread-External Thread-Thread Nomenclature(Major dia-Minor dia-Pitch dia-pitch)-Full name of terms BSW-BSP-TPI .Safety precautions in Fitting Shop.
3.	Sheet Metal Work (Fabrication Shop)	Specification of sheet metal-SWG vs. mm-HR sheet- CR sheet-GI Sheet-Stainless Steel Sheet-Aluminum sheets-Tin Plates- Sheet metal working Tools – Micrometer-Chisels-Punches-Hammers-Mallets-Hand Shear or Snips-Various sheet metal forming operations-Shearing-Marking-Punching-Drilling-Bending-Drawing-Brazing- Safety precautions in Sheet Metal Working Shop.
4.	Welding Shop	Welding-Weldability-Types of Welding-MMAW-Gas Welding-Electrode – Functions of Flux-Equipment for MMAW-Different types of Flames in Gas Welding (Neutral-Oxidising-Reducing)-Different types of welding joints-AC Welding-DC Welding- Various types of welding joints-Butt joint-Fillet Joint-Safety precautions in Welding Shop.
5.	Casting and Foundry shop	Mould making-Preparation of sand –(silica-clay-moisture-and misc items and their functions)-Properties of a good sand mould-General procedure for making a good sand mould-Different tools used for preparation of a mould – Explanation of various terms –Cope and Drag Box-Runner-Riser-Gating and its utility – Parting sand-Vent holes-Casting
6.	Machine Shop	Machining and common machining operations – Lathe M/c and its specifications-explanations of head stock-tailstock-chuck-self centering chuck-4 jaw chuck-Bed-carriage-feed mechanism-Screw cutting mechanism-various lathe operations like turning-facing-grooving-Chamfering-taper turning-Thread cutting-Knurling-Cutting speed-Feed-Depth of cut
7.	Milling Machine	Description of a milling machine-Specification of a Milling machine-Types of Milling-Up Milling-Down Milling-Vertical Milling Machine-Horizontal Milling Machine-
8.	Shaping Machine	Description of a Shaping machine-Base –Column-Saddle-Clapper box-Quick return mechanism-Feed Mechanism-Table-Rotation of table-Adjustment of stroke length-

HERITAGE INSTITUTE OF TECHNOLOGY

Department of Mechanical Engineering

Subject: Workshop Practice **Subject Code: MECH1011**

Note: The report must be submitted in A4 Size paper on both sides with cover page, page no, border line & roll no on each page in a channel file.

CARPENTRY SHOP

1. What are the differences between Hard Wood & Soft Wood?
2. Name two methods of seasoning
3. Name three advantages of seasoning
4. Name a cutting, planning, striking, boring, holding, marking tool and draw the diagram of each one in relation to carpentry shop.
5. Name different processes that are involved in a typical carpentry job and the tools used for those operations.
6. Explain the terms Log, Batten, Plank, and Beam.
7. How are the following tools classified in relation to the operation they perform?
8. How are these tools specified?
   i. Try Square
   ii. Jack Plane
   iii. Vice
   iv. Marking Gauge
   v. Mortise Gauge
   vi. Rip Saw
   vii. Bench Vice

FITTING SHOP

1. Name five important operations that are performed in fitting shop and tools used to perform those operations
2. Draw the following tools used in a fitting shop with a neat sketch for each of them.
   i. Bench Vice
   ii. Flat Chisel
   iii. Adjustable frame Hack Saw
   iv. Flat File
   v. Half Round File
   vi. Ball Peen Hammer
   vii. Outside Spring Caliper
3. How do you calculate the drill size for doing internal thread in a job piece?
4. Why are three taps used for doing an internal thread by hand?
5. Name the tool used for making an external thread by hand and explain how to make a external thread by hand using that tool?
6. Draw a typical thread and mark major dia, minor dia, pitch dia, depth of thread.
7. What do the abbreviations mean- BSW, BSP, TPI stand for in relation to a thread?

MOULDING AND CASTING SHOP

1. Describe the following tools that are used in foundry shop .What purpose are they used for?
   i. Trowel
   ii. Lifter
   iii. Rammer
   iv. Strike off bar
   v. Vent rod
   vi. Draw spike
   vii. Cope and Drag box.
2. Why is sand used for preparing a mould?
3. What are the ingredients that are mixed with sand in order to make a good mould and why are they used?
4. Describe the following terms in relation to a mould
   i. Runner
   ii. Riser
   iii. Vent holes
   iv. Gate
5. Draw typical green mould sand and label the following:
   i. Cope Box
   ii. Drag Box
   iii. Runner
   iv. Riser
   v. Parting Line

SHEET METAL SHOP

1. What is the full name of SWG, HR sheet, CRCA sheet, GI sheet?
2. Name various sheet metal forming processes and the tools used to perform each of those processes.
3. Name few sheet metal working processes and the tools used for each of those processes.
4. Draw the following tools used in Sheet metal work
   - i. Hand Shears
   - ii. Round Mallet
   - iii. Prick Punch
   - iv. Bench Vice
   - v. Sheet Metal Gauge

WELDING SHOP

1. What is weldability?
2. Describe MMAW & Gas Welding.
3. Describe three types of flames in Gas welding with sketch.
4. What is the basic equipment that constitutes an Arc welding system?
5. Why a step down transformer is used in Arc welding process?
6. What are the functions of flux used in electrodes?
7. Describe different types of welding joints
8. What are the safety precautions that need to be observed in welding shop?

MACHINE SHOP

LATHE

1. How a lathe machine is specified? Describe principal components of a centre lathe.
2. Describe the following operations with schematic diagram –Turning-Taper turning-Facing-Grooving-Chamfering-Thread Cutting.
3. Explain Cutting speed, Feed & Depth of cut in relation to turning operation in lathe.

MILLING

1. How a Milling machine is specified?
2. What's the difference between UP milling and DOWN milling?
3. What operations may be done in a milling machine?

SHAPING MACHINE

1. Draw and explain a quick return mechanism in a shaping machine.
2. Explain the function of a clapper box.
3. How the stroke length and position of stroke in a shaping machine is adjusted?
4. Describe the feed mechanism in a shaper

HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING

WORKSHOP PRACTICE (MECH1011)

WORK INSTRUCTION SHEET

CARPENTRY SHOP

NTRODUCTION: Carpentry may be defined as the process of making wooden components. It starts from a arketable form of wood and ends with finished products. It deals with the building work, furniture, cabinet making. tc. joinery, i.e., preparation of joints is one of the important operations in all wood- works. It deals with the specific ork of carpenter like making different types of joints to form a finished product.

OOLS USED:

Types of Tools	Name of Tools	Specification	
		Size	Material of Construction
A. Holding Tools	Carpenter's Vice	Jaw Width / Wide – 7'' / 150mm Opening – 6'' / 130mm	Cast Iron Frame Plated Steel Screw and Slide bar
	C-Clamp	Opening capacity and load capacity	Ductile iron, hardened steel cup point set screw and locknut
B. Measuring Tool	Steel Rule	12" (Maximum measureable length) Least Count	Stainless steel
	Steel Tape	Maximum measureable length Least Count	Cold rolled steel strip
	Try Square	6" (Length of the blade)	**HCS** / stainless steel
C. Marking Tool	Marking Gauge	Length of the stem	Wood
	Mortise Gauge	length of the stem	wood
	Scriber	length of the blade	Stainless steel
	Compass and Divider	maximum diameter that can be drawn	High carbon steel
D. Planning Tool	Jack Plane	Length and blade width	Tool steel / Wood
E. Cutting Tool	Rip Saw	Length of the blade and teeth per unit length	Tool steel
	Firmer Chisel	Blade width and length	**HCS / tool steel**
	Mortise Chisel	Blade width and length	**HCS / tool steel**
F. Boring Tool	Carpenters Brace	**Maximum shank diameter of the of the spindle**	
	Auger Bit		
	Gimlet	**Diameter of shank**	high carbon steel
G. Striking Tool	Wooden Mallet		wood
	Claw Hammer	weight	Forged high carbon steel
	Ball Peen Hammer	200 gm (Weight)	Forged high carbon steel
H. Miscellaneous	Screw Driver	Type and length	Tool steel
	Wood Rasp File	Length	**HCS/Tool steel**
	Pincer	length	forged steel

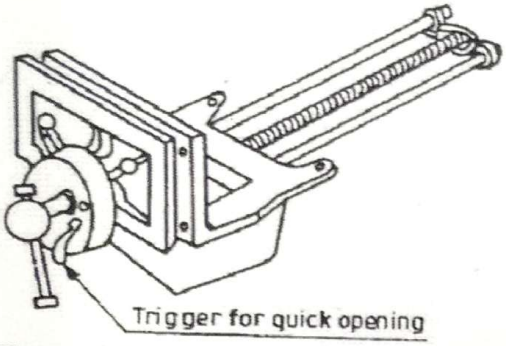


Figure 1.1: Carpenters vice

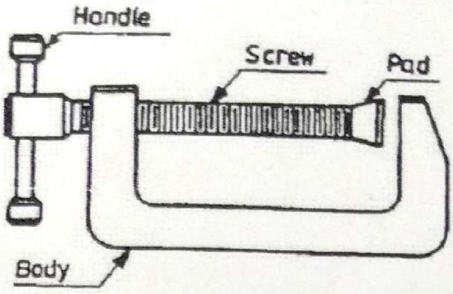


Figure1. 2: C-clamp

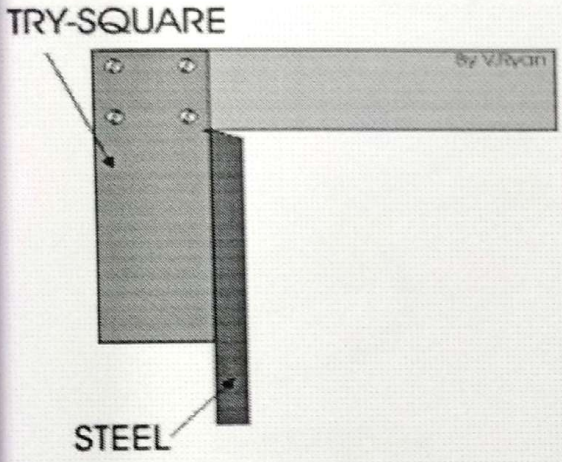


Figure 2.2: Try square

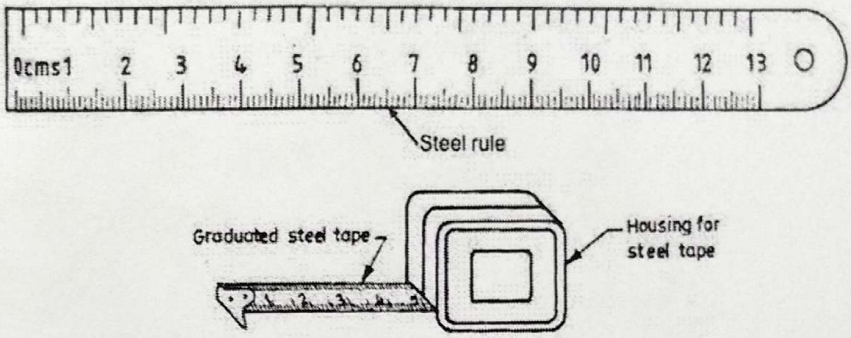


Figure 2.1: Steel Rule and Steel Tape

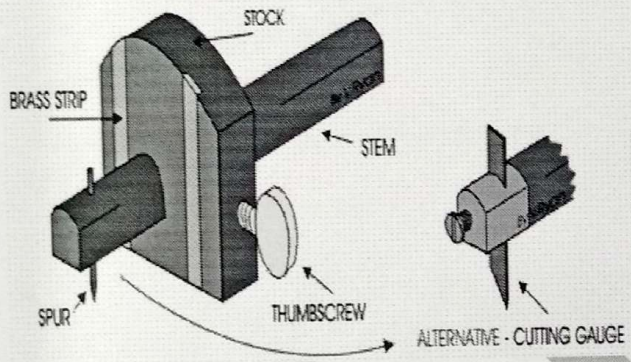


Figure 3.1: Marking gauge

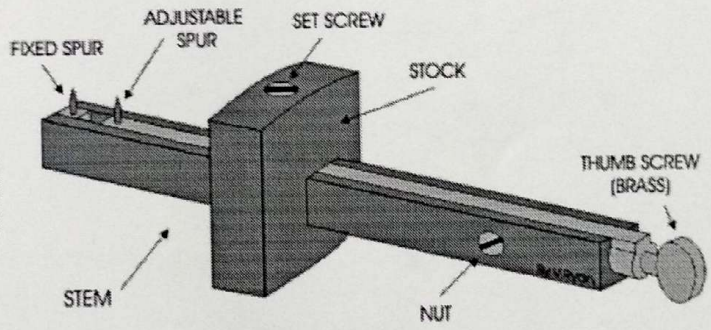


Figure 3.2: Mortise gauge

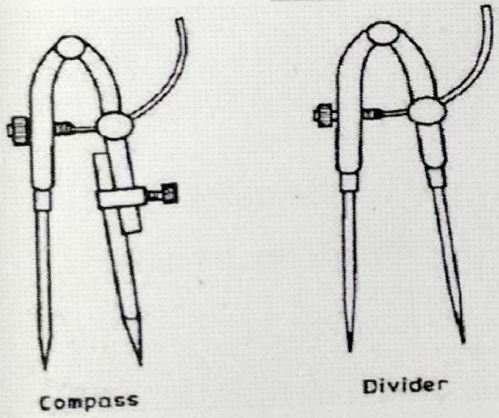


Figure 3.3: Compass and Divider

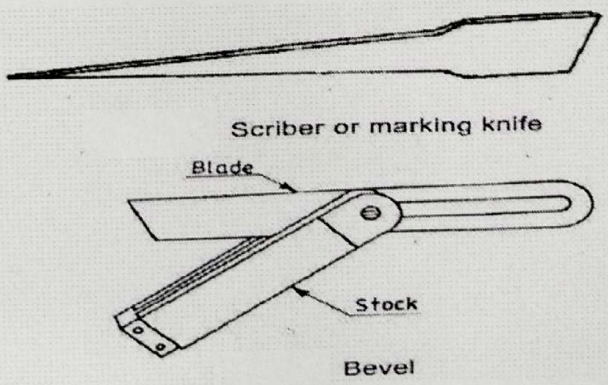


Figure 3.4: Scriber or Marking Knife and Bevel

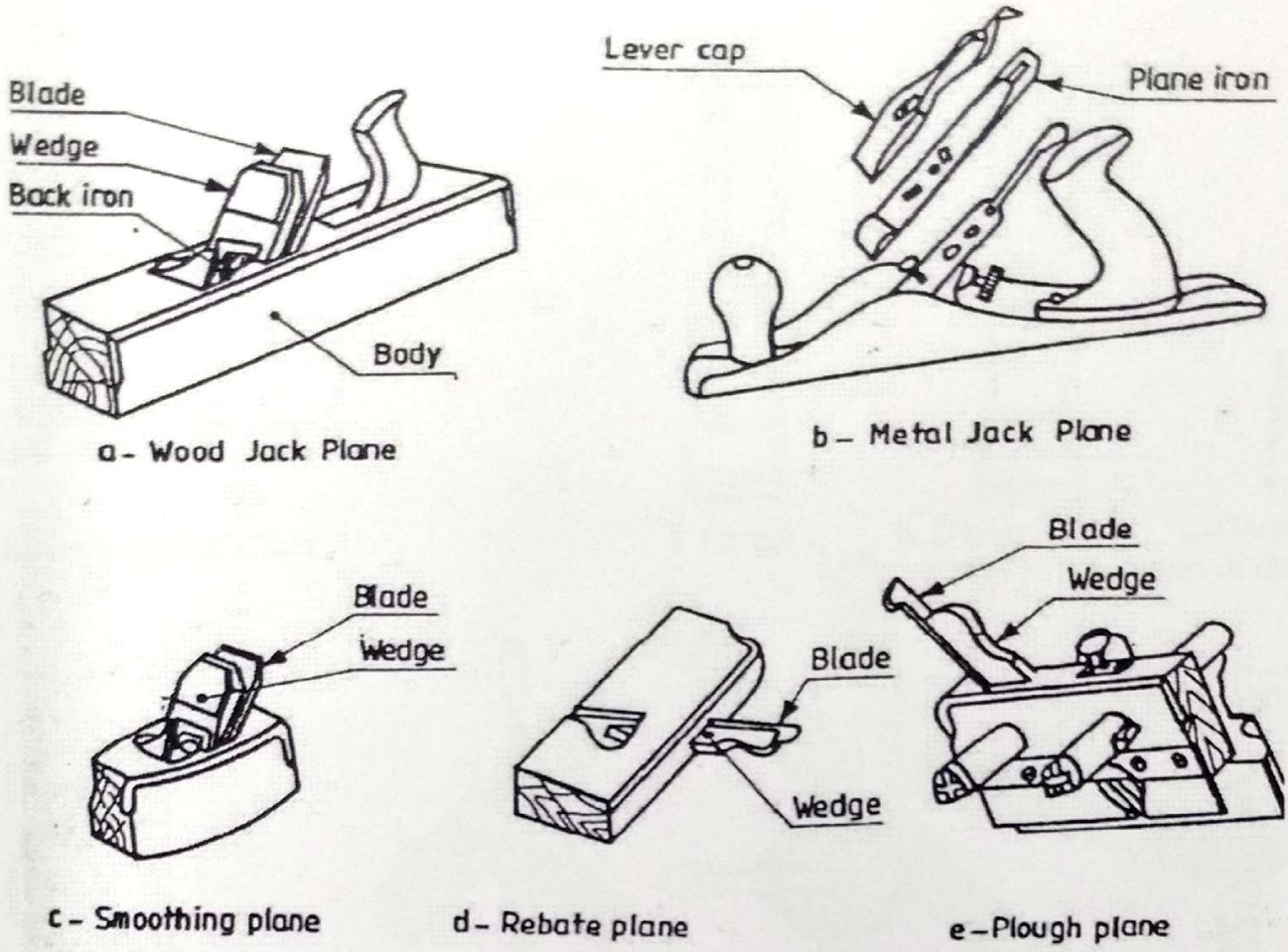


Figure 4.0: Types of Planes

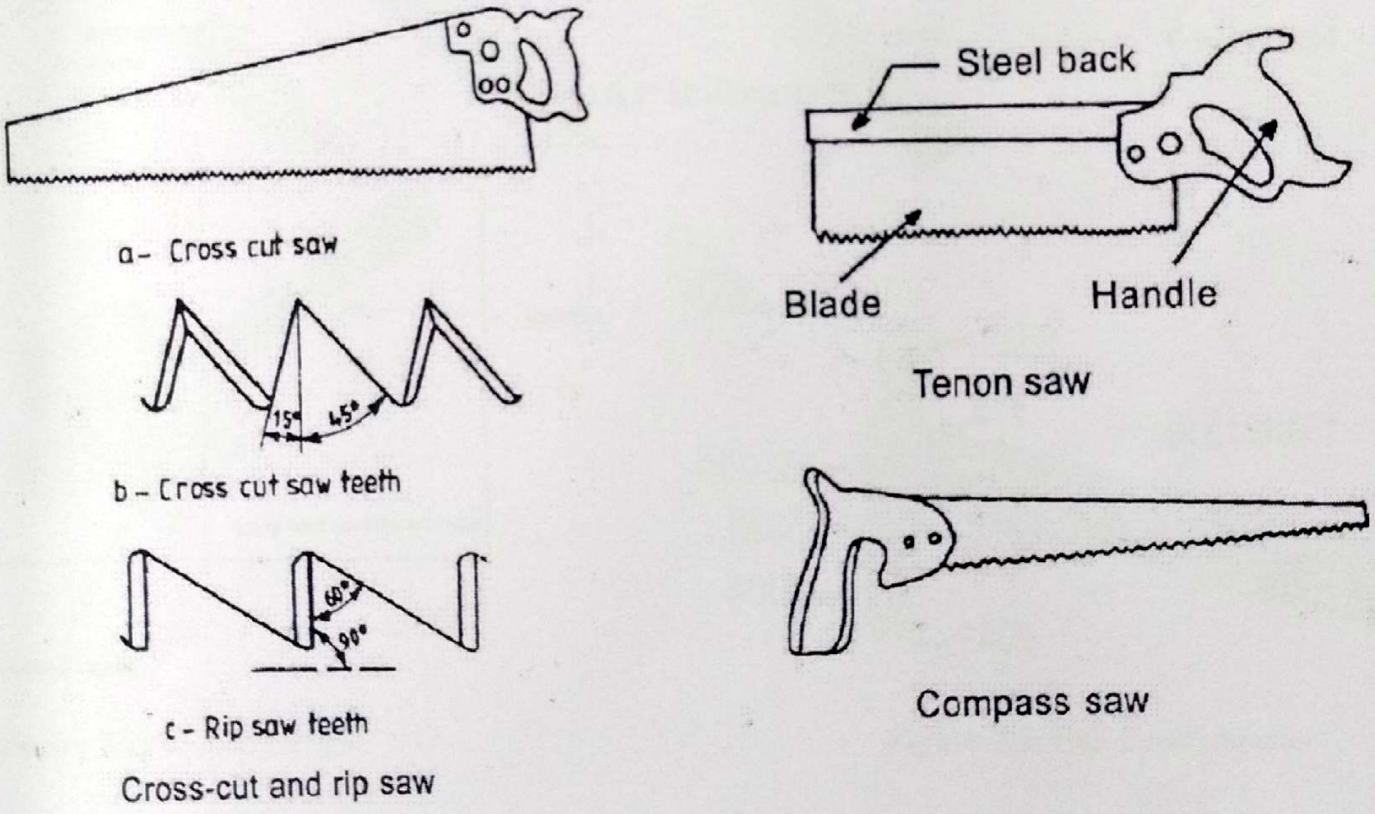
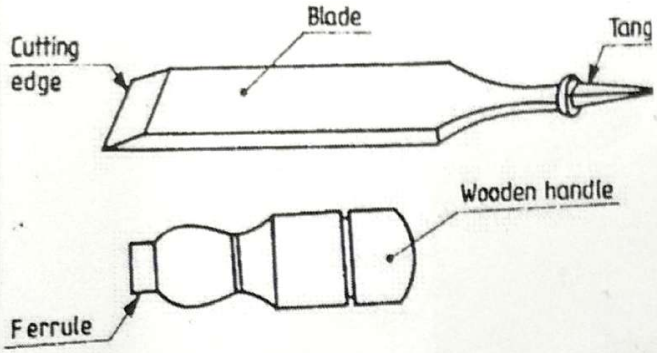
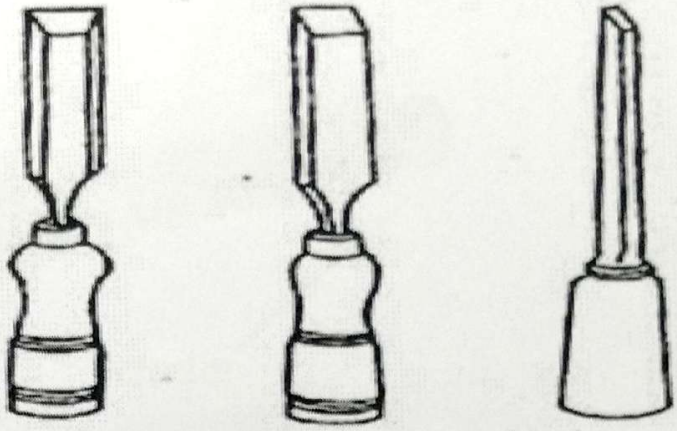


Figure 5.1: Types of saws



gure 5.2: Different Parts of Chisel



a. Firmer b. Dovetail c. Mortise

Figure 5.3: Types of chisels

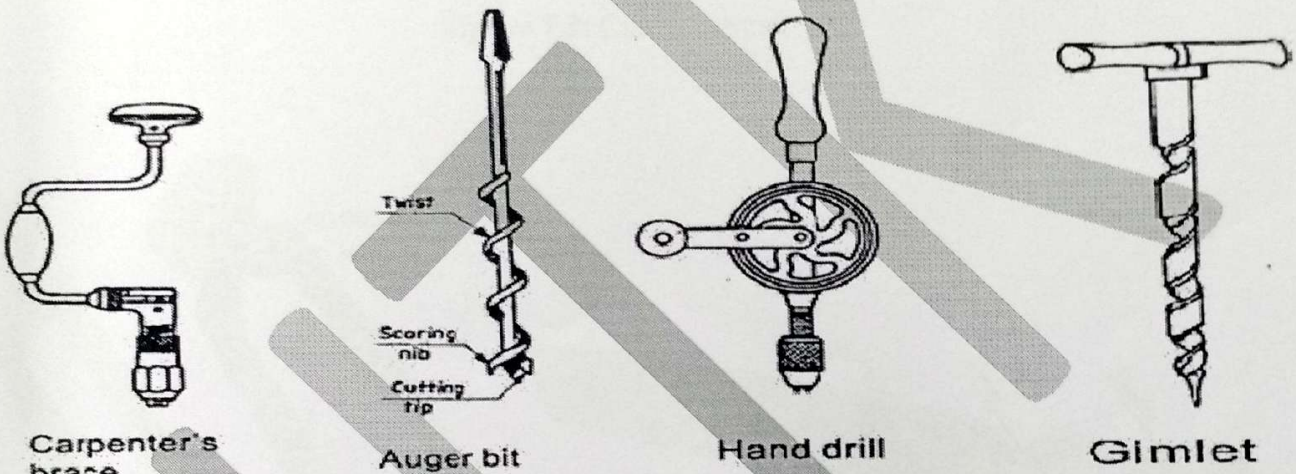


Figure 6.1: Drilling tools

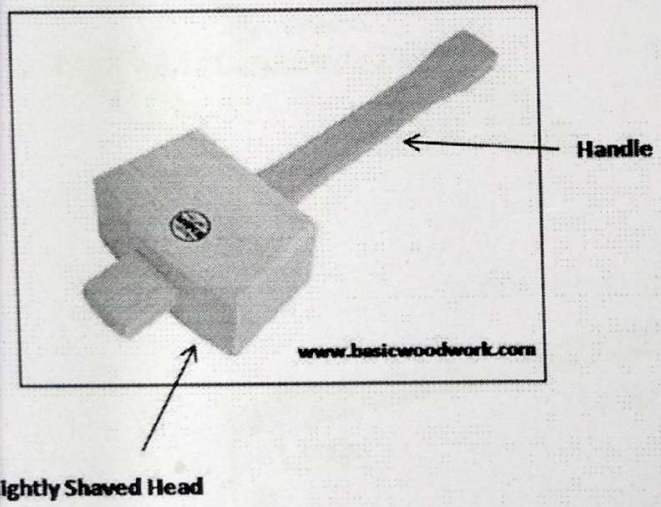


Figure 7.1: Wooden Mallet

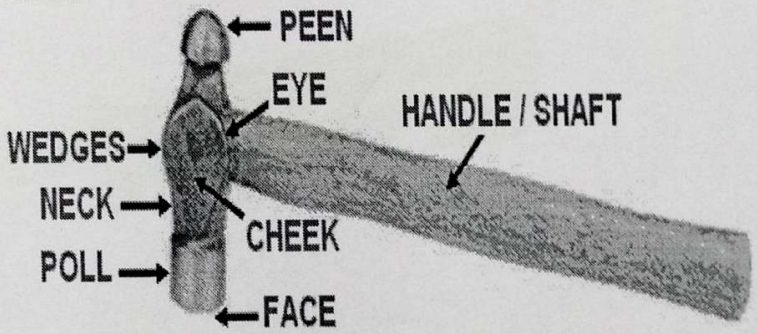


Figure 7.2: Ball Peen Hammer

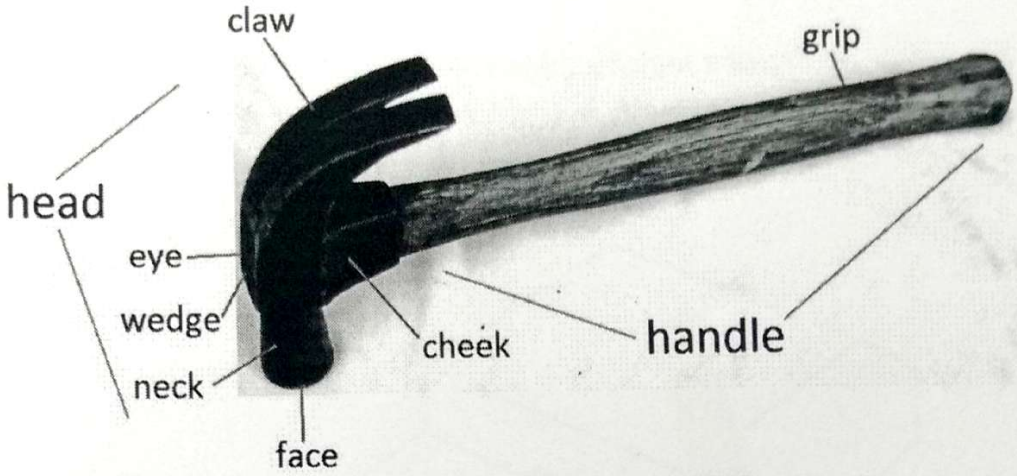


Figure 7.3: Claw Hammer

Figure 8.1: Carpenter's Pincer

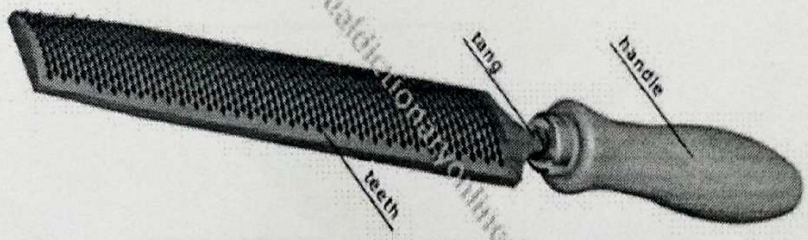


Figure 8.2: Wood Rasp File

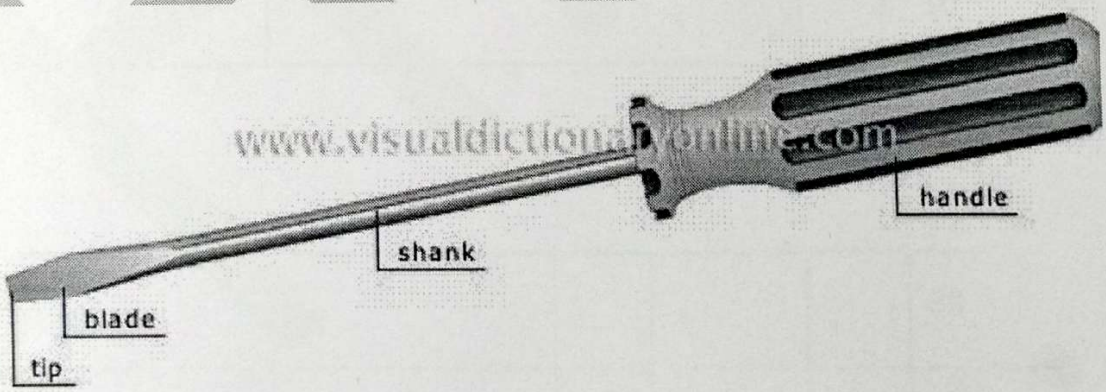


Figure 8.3: Screw Driver

JOB 1
Job No: MECH1011/01

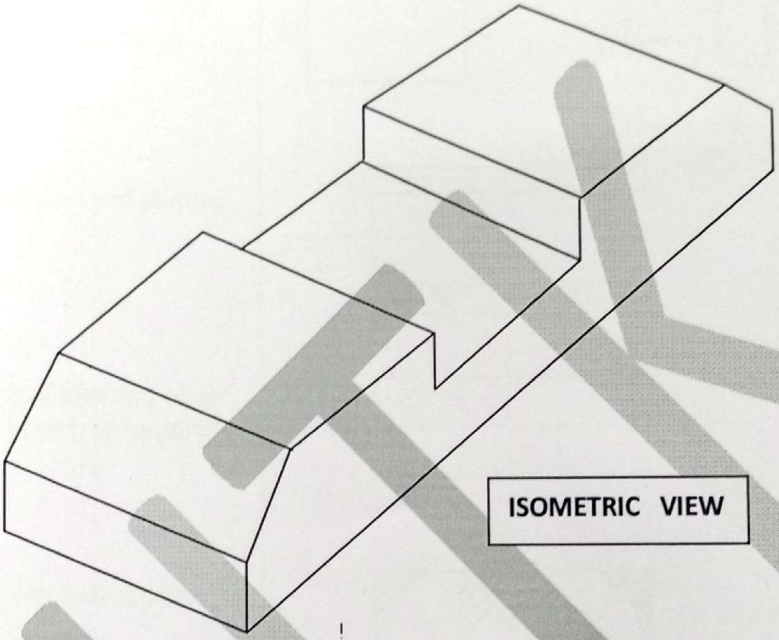
ame of the Job: Making one half of a cross halving joint

aw Materials: Soft Wood / Hard Wood (Gamma)

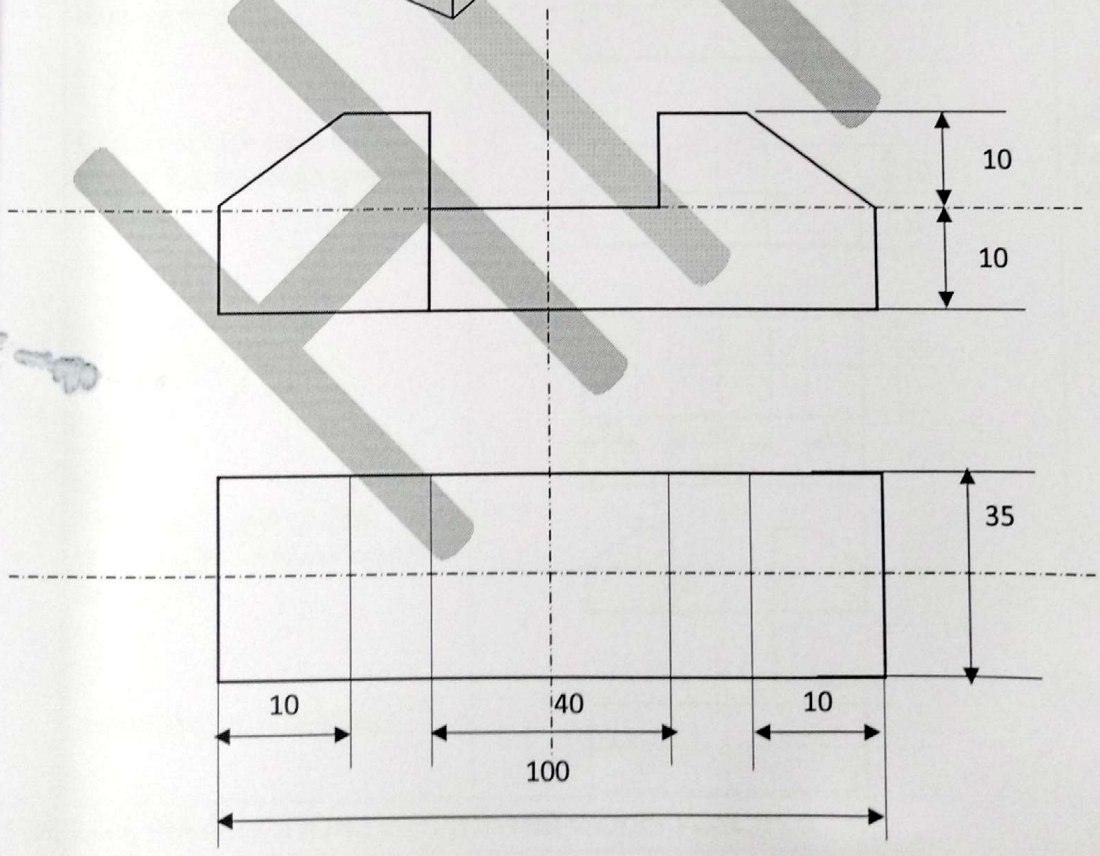
aw Material Size: 40mm x 24mm x 1.5 to 2cm approx (width x height x length)

ools Required: 1. Steel Rule, 2. Rip Saw, 3. Metal Jack Plane, 4. Mortise Gauge, 5. Firmer Chisel, 6. Ball Peen Hammer, 7. Try Square and 8. Pencil (for Marking).

rawing of the job:

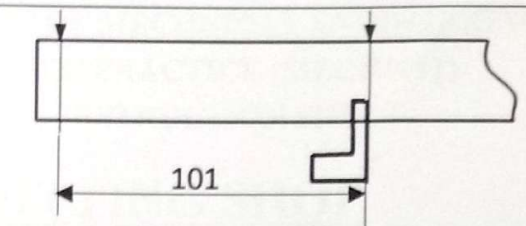
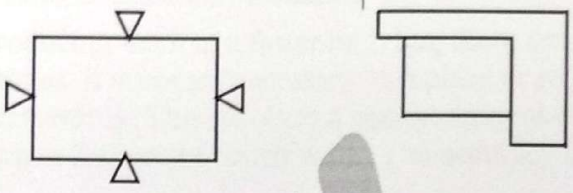
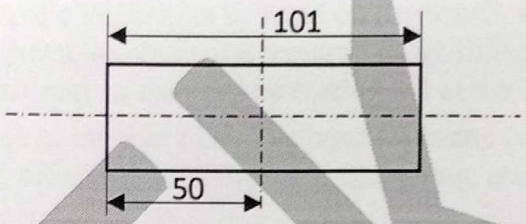
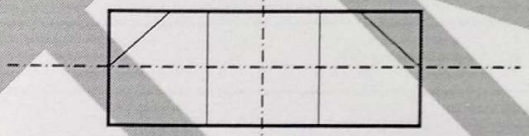
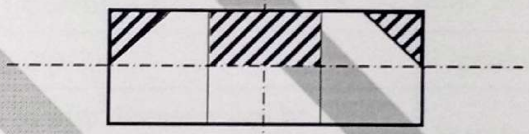
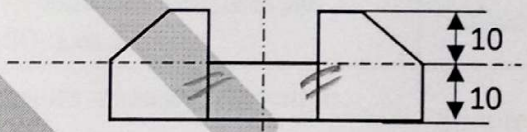
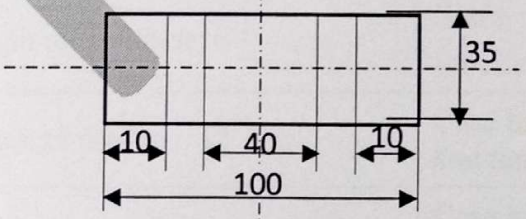
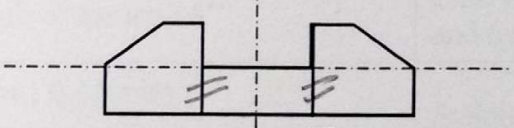
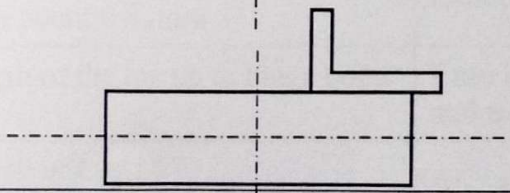


ISOMETRIC VIEW



ORTHOGRAPHIC VIEW

QUENCE OF OPERATION: MECH 1011

No.	Operation	Schematic diagram	Tools required
	Marking and parting off required length, with necessary cutting allowance.		Scale, Try square, Scriber, Rip saw.
	Planning all four surfaces for parallelism and squareness.		Jackplane, Try square.
	Making centerline and parting off.		Try square, Marking gauge, Scriber, Scale.
	Marking centerlines and other construction lines, as required.		Try square, Marking gauge, Scriber, Scale.
	Sawing the sidewalls up to required length.		Rip saw
	Chisel out the excess material for making the rough groove.		Firmer chisel, Ball-peen hammer.
			
	Finishing the grooves for proper relationship between the mating parts.		Firmer chisel, Ball-peen hammer.
	Assembling and checking		Try square.

ET DETAIL INSTRUCTIONS FROM YOUR CLASS TEACHER

HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING

WORKSHOP PRACTICE (MECH1011)

WORK INSTRUCTION SHEET

FITTING SHOP

troduction: Machine tools are capable of producing work at a faster rate, but, there are occasions when mponents are processed at the bench. Sometimes, it becomes necessary to replace or repair component which must fit accurately with another component on reassembly. This involves a certain amount of hand fitting. The assembly machine tools, jigs, gauges, etc, involves certain amount of bench work. The accuracy of work done depends upon e experience and skill of the fitter.

ne term 'bench work' refers to the production of components by hand on the bench, where as fitting deals which the sembly of mating parts, through removal of metal, to obtain the required fit by filling, chipping, sawing, scraping, pping etc after the machine operations and this may or may not be carried out at the bench.

oth the bench work and fitting requires the use of number of simple hand tools and considerable manual efforts. The erations in the above works consist of filing, chipping, scraping, sawing drilling, and tapping.

OOLS USED:

Types of Tools	Name of Tools	Specification	
		Size	**Material of Construction**
. Holding ools	Bench Vice	Jaw Width – 4'' / 100mm Jaw Opening – 4 ¾ '' / 120mm	Carbon Steel Jaw, Plated Steel Screw and Bar
	C-Clamp	C-Clamp	Opening capacity and load capacity
	V-Block	Max & Min diameter can be hold, Inclination	Stainless Steel / Carbon
3. Measuring Tool	Steel Rule	12" (Maximum measureable length), Least Count	Stainless Steel
	Steel Tape	Maximum measureable length Least Count	Stainless Steel
	Try Square	Length of the blade: 6''	Blade : Hardened steel Stock : Cast Iron or steel
	Outside Caliper	Length of the leg : 12'' / 6''	Case hardened mild steel or hardened and tempered low carbon steel
	Inside Caliper	Length of the leg : 6''	Case hardened mild steel or hardened and tempered low carbon steel
	Vernier Caliper	Range : 0-150mm Least count:0.01mm	Stainless Steel, Carbide tipped Jaws
C. Marking Tool	Odd Leg Caliper	Length of the leg up to hinge point : 6''	Case hardened mild steel or hardened and tempered low carbon steel
	Trammel	Length of Leg : 6'' Clamp Opening Accommodates	Wood / Knurled Aluminum
	Scriber or Marking Knife	Length ranges from 150mm to 250mm	Hardened and tempered High Carbon Steel

	Compass and Divider	Length of the leg	Case hardened mild steel or hardened and tempered low carbon steel
	Punches	Length : 3'' / 4'' Diameter : Include angle : 60° / 90°	High carbon steel
D. Cutting Tool	Hack Saw	Length of the blade Teeth per unit length (cm): 5-15	H.S.S or low alloy steel Hardened Teeth
	Chisel	Blade width and length	0.9% to 1.0% Carbon steel (annealed, hardened and tempered)
E. Drilling Tool	Twist Drill	Diameter of the hole No of Starts , Shank type	High speed steel
F. Striking Tool	Ball Peen Hammer	Weight : 200gm Head Length Face Dimension	Forged high carbon steel
	Cross-Peen Hammer	Weight Head Length Face Dimension	Forged high carbon steel
	Straight Peen Hammer	Weight Head Length Face Dimension	Forged high carbon steel
G. Finishing Tool	Files	Length : 12'' Cross Section : Round / Flat / Triangular No of cuts : Double Cut	Heat-treated high carbon steel PVC / Wooden handle
	Reamer	Diameter	High speed steel
H. Threading Tool	Taps Tap Wrenches	M-8 x 1.25, Standard Size	HSS
	Dies and Die-Holders	M-8 x 1.25, Standard Size	HSS
I. Miscellaneous	Screw Driver	Size / Length : Type : Magnetic / Nonmagnetic Screw Head Type : Slotted /	
	File Card	Wire Diameter	High Carbon Steel Wire
	Spanner	Type : Box/Ring/Socket/ Adjustable	Chromium-Vanadium alloy Tool Steel
	Spirit Level	Length x Width	Aluminum/Molded Plastic/Plastic

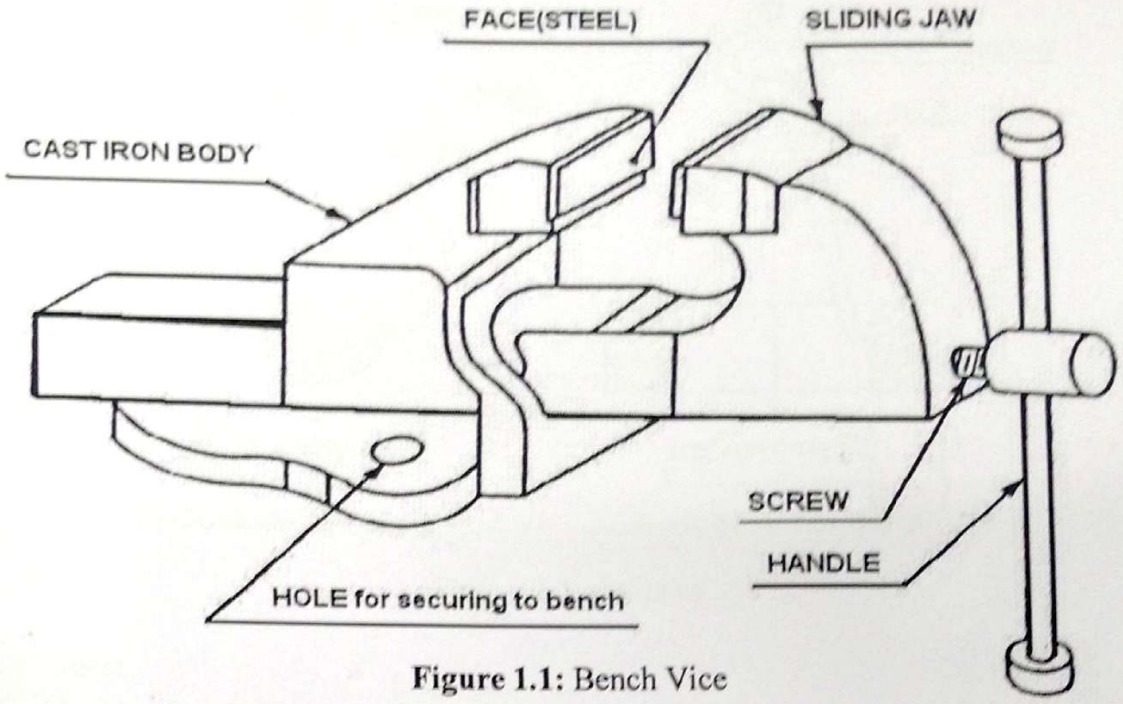


Figure 1.1: Bench Vice

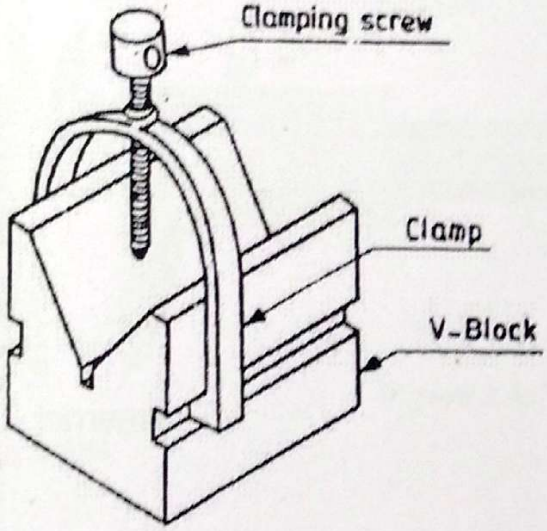


Figure 1.2: V-Block

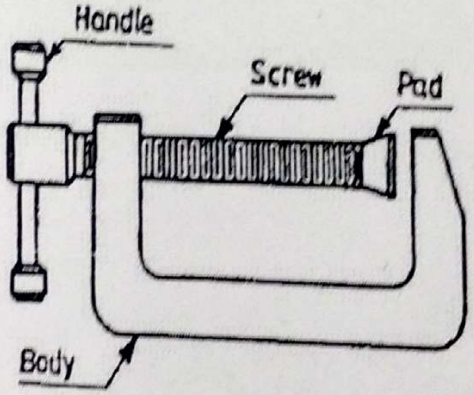


Figure 1.3: C-Clamp

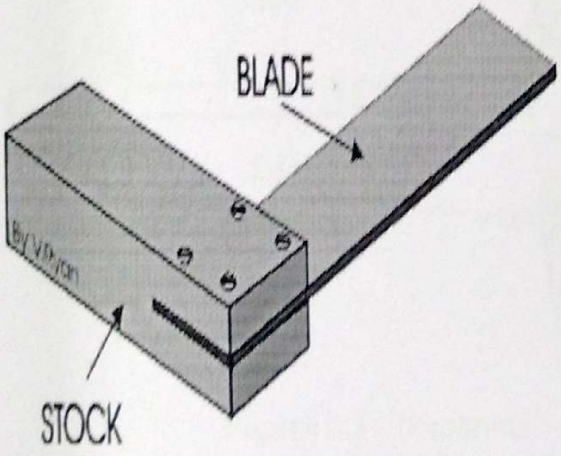


Figure 2.1: Try Square

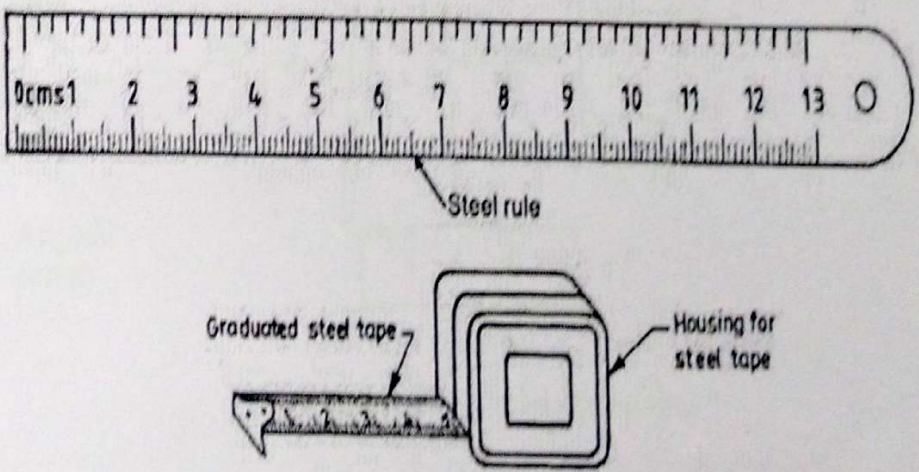


Figure 2.2: Steel Rule and Steel Tape

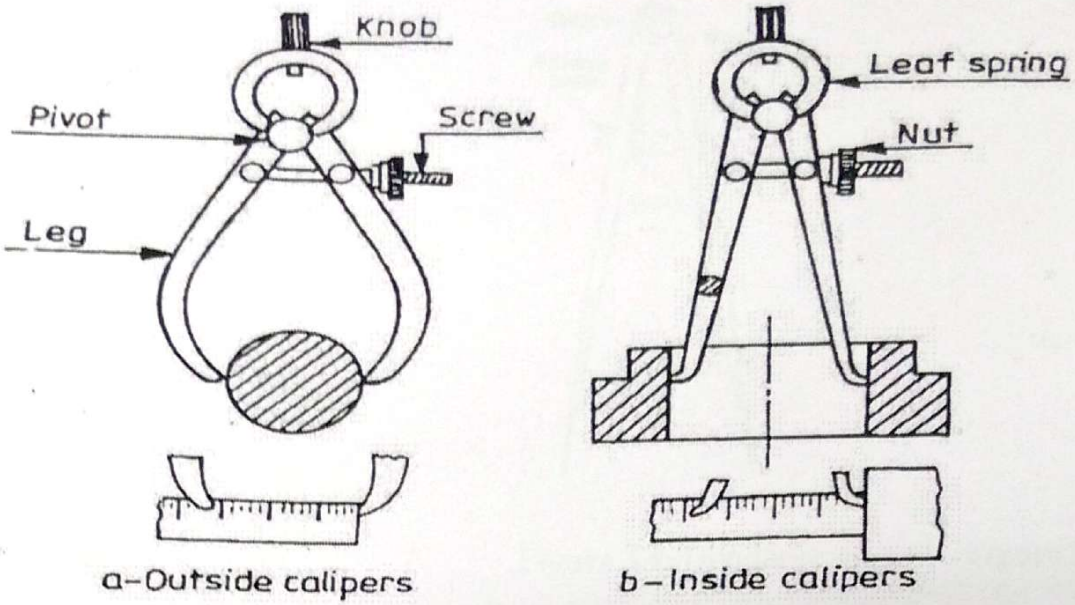


Figure 2.3: Calipers

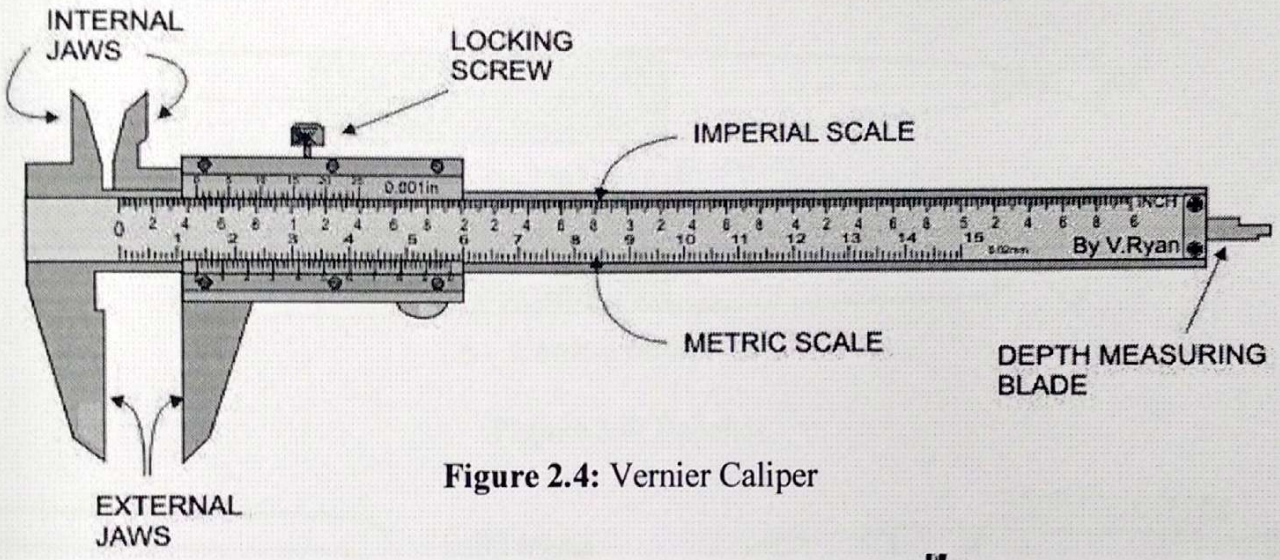


Figure 2.4: Vernier Caliper

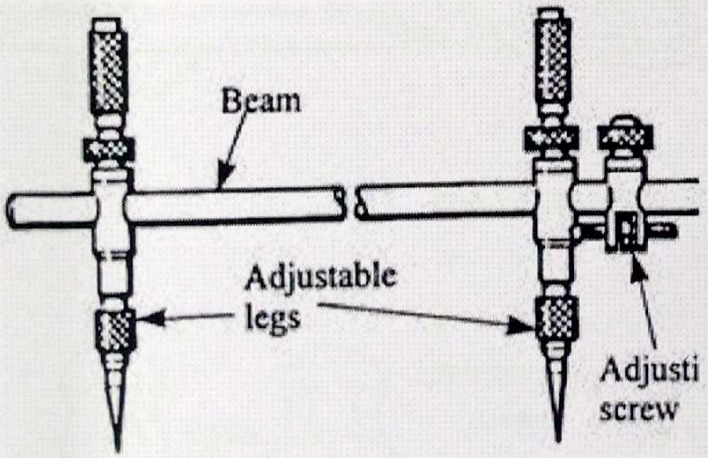


Figure 3.1: Trammel

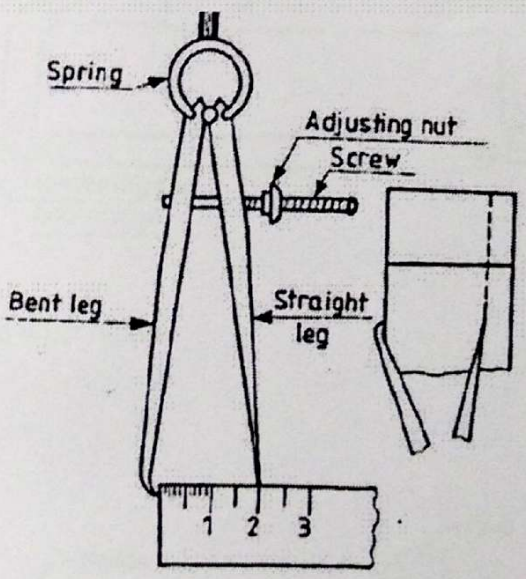


Figure 3.2: Odd-Leg Caliper

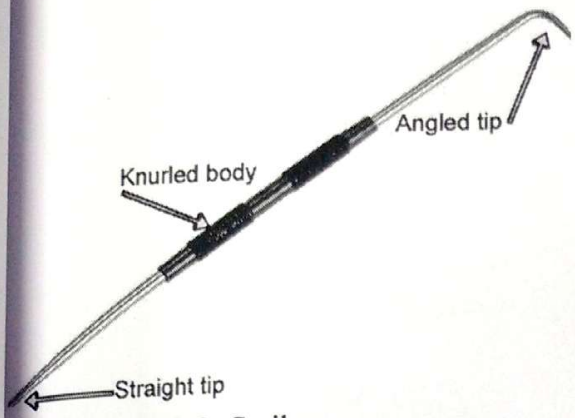


Figure 3.3: Scriber

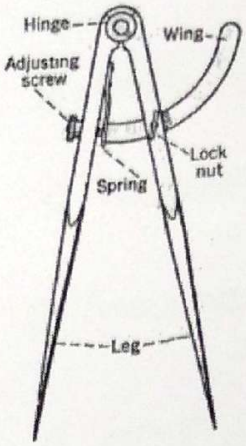


Figure 3.4: Divider

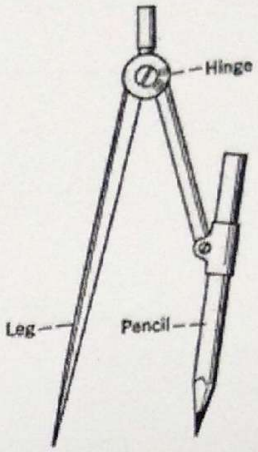


Figure 3.5: Compass

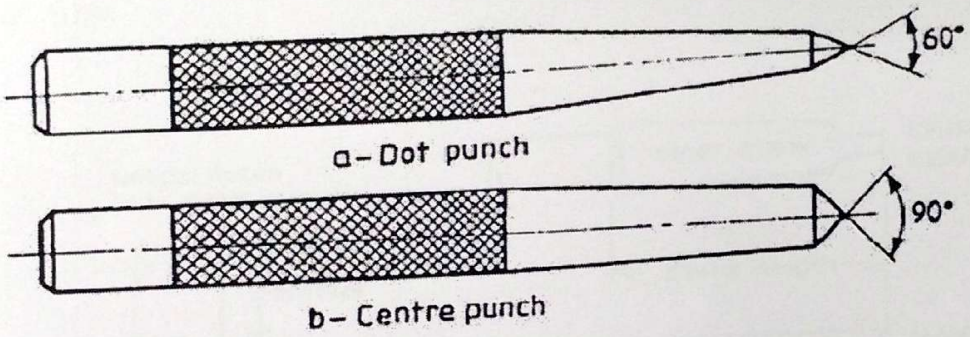


Figure 3.6: Punches

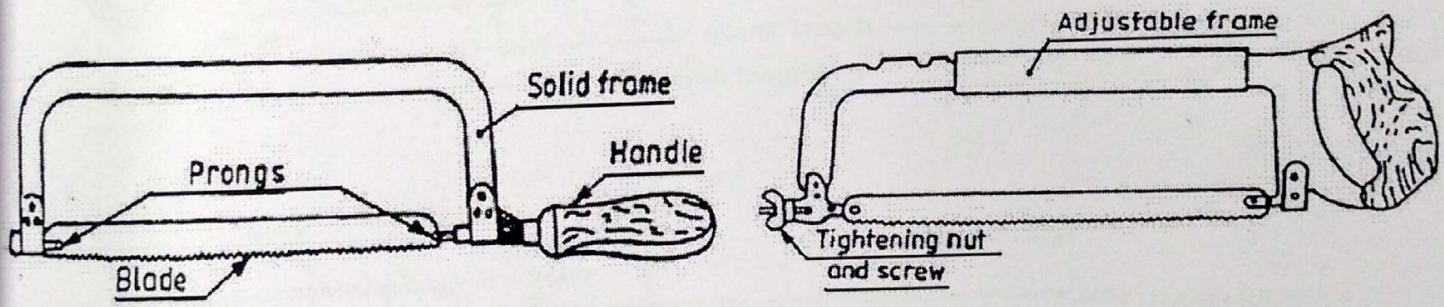


Figure3.7: Hacksaw frame with blade

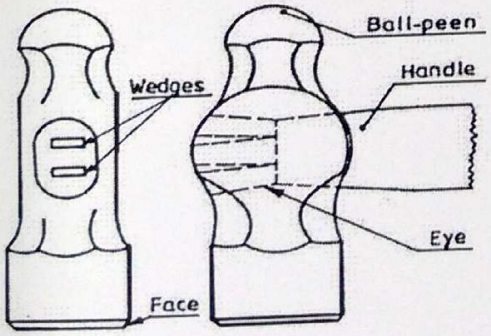


Figure 6.1: Ball Peen Hammer

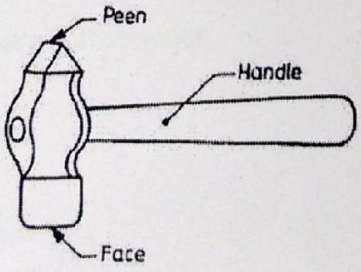


Figure 6.1: Ball Peen Hammer

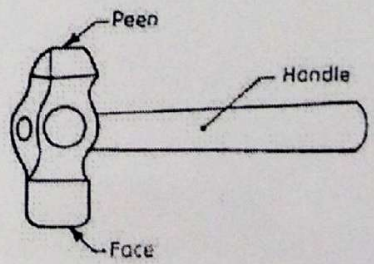
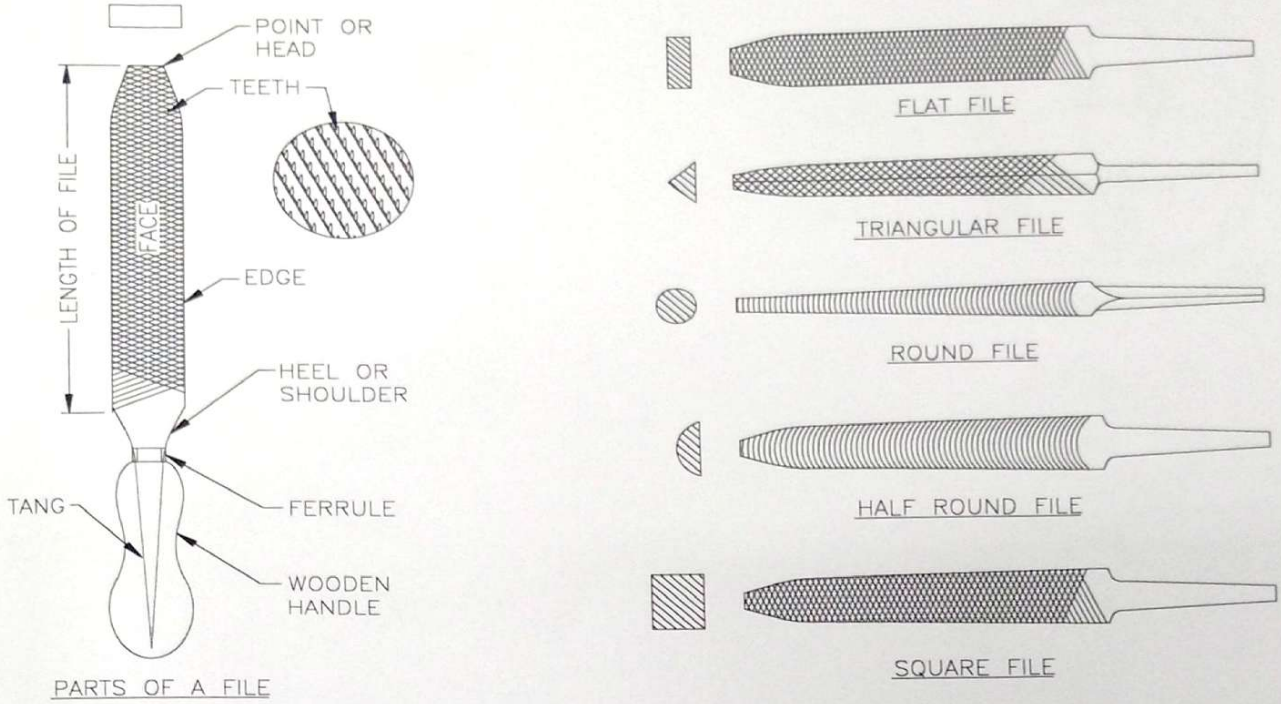


Figure 6.1: Ball Peen Hammer



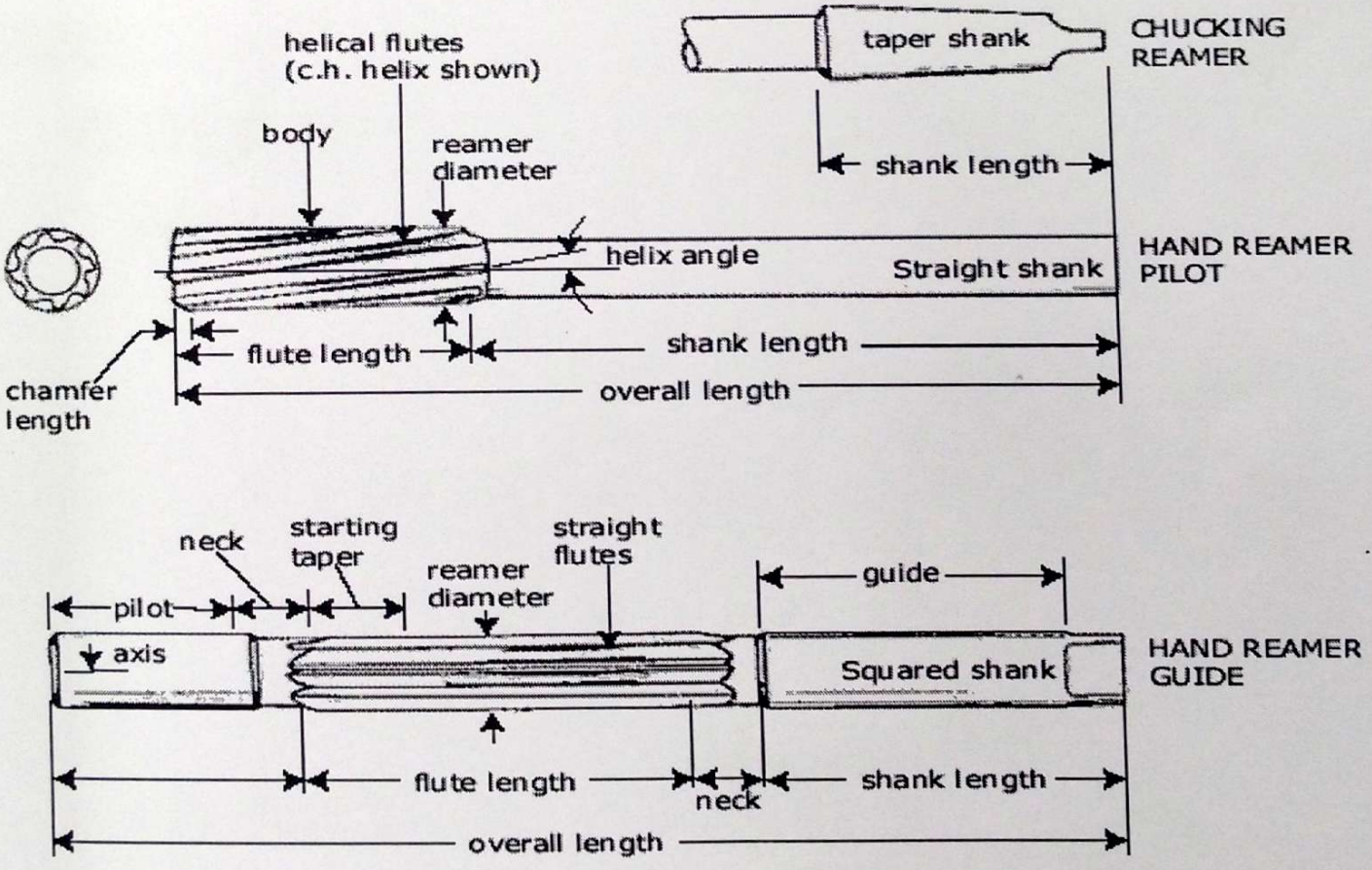


Figure 7.2: Reamer

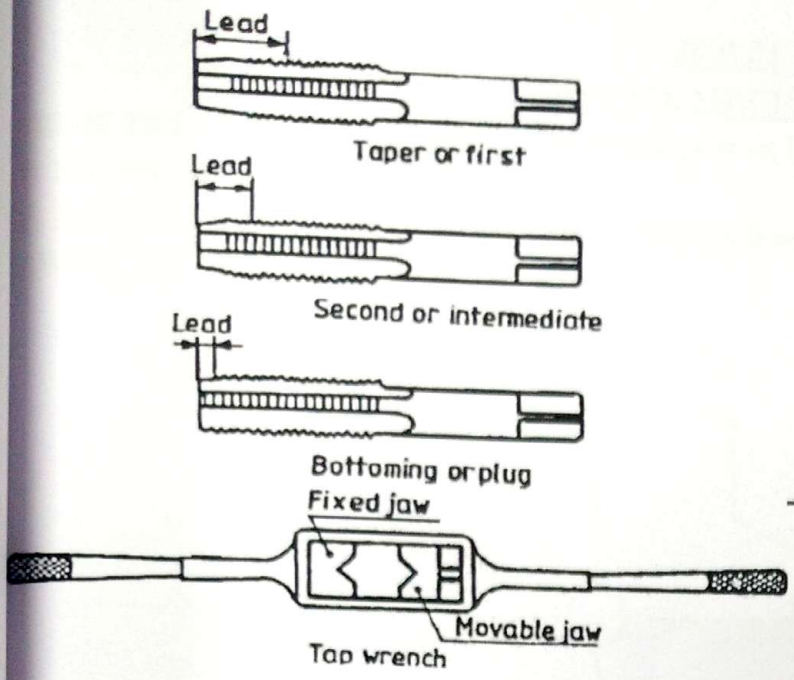


Figure 8.1: Taps and Tap Wrench

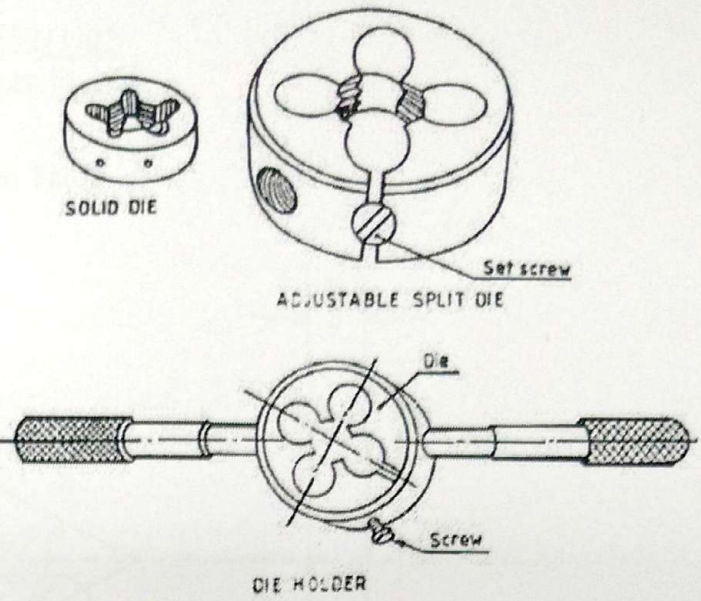


Figure 8.2: Dies and Die Holder

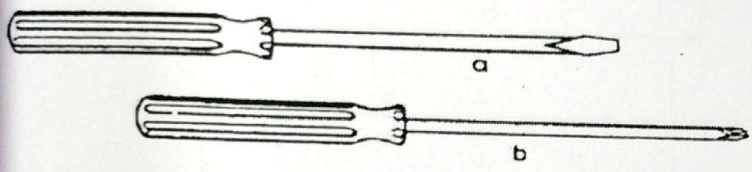


Figure 9.1: Screw Driver

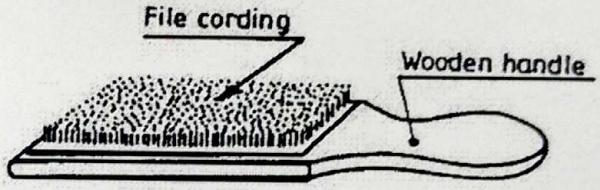


Figure 9.2: File Card

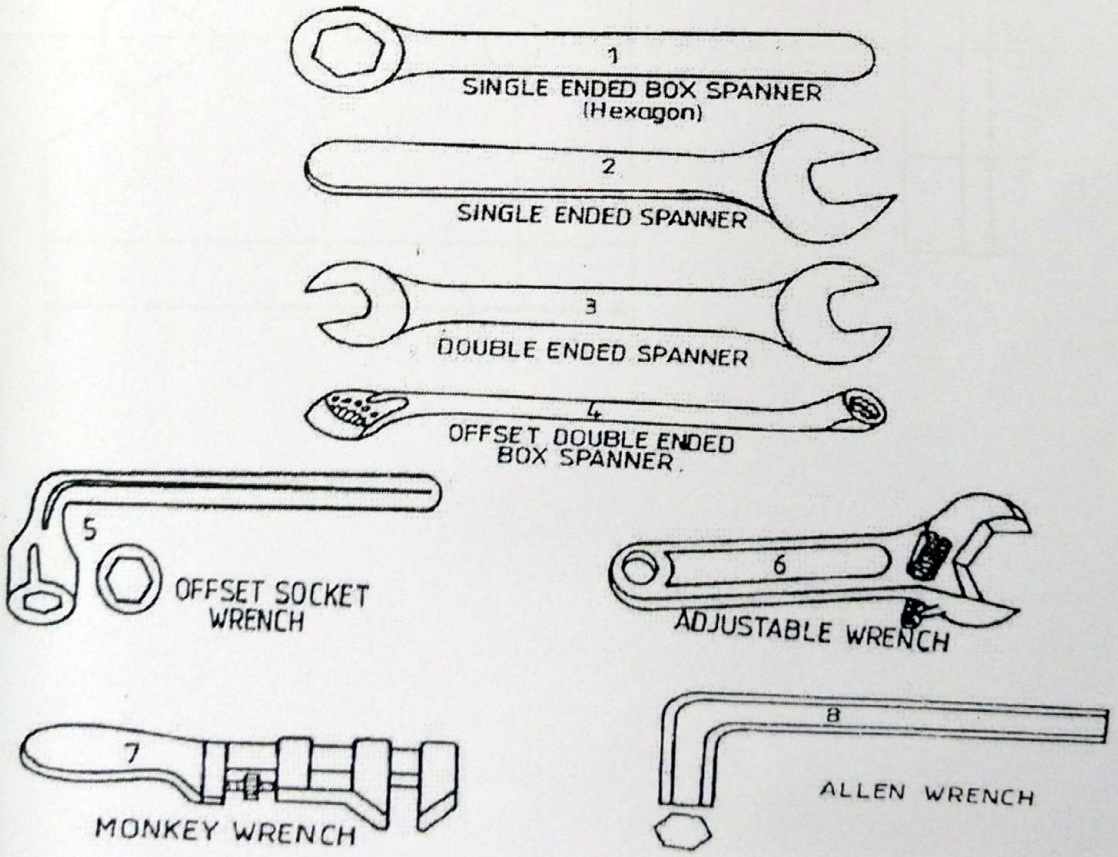


Figure 9.3: Spanners

JOB 01

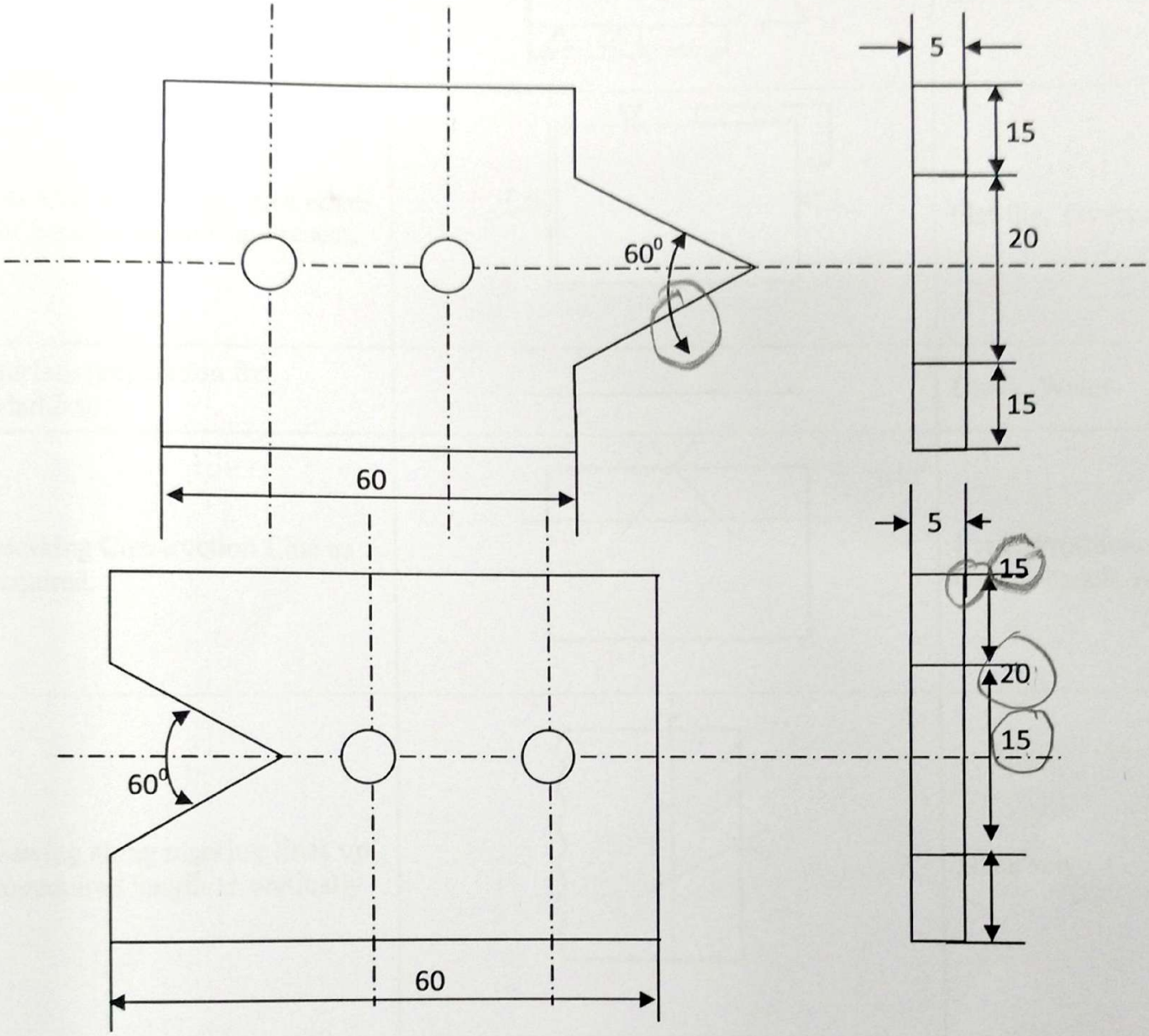
JOB NO. MECH1011/02

ME OF THE JOB: Making a Male or Female Gauge from MS Plate

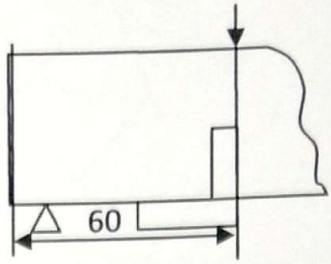
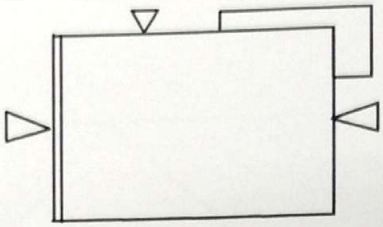
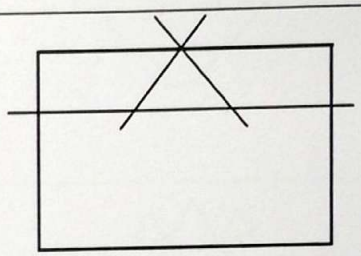
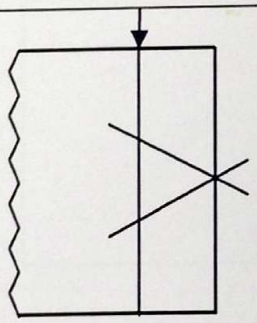
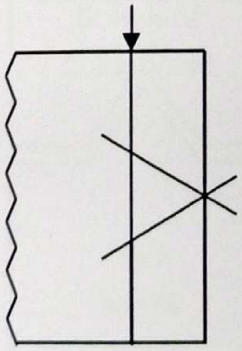
W MATERIALS: Mild Steel Plate

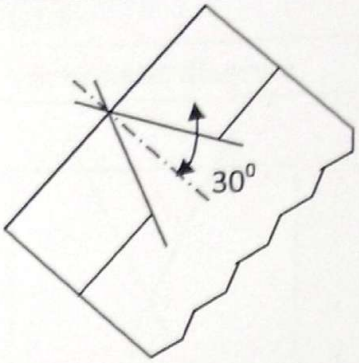
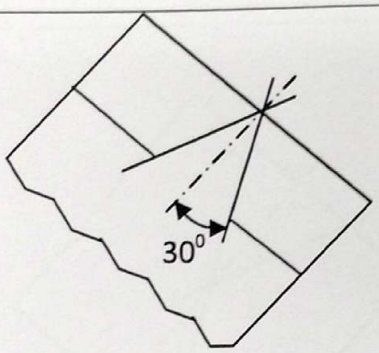
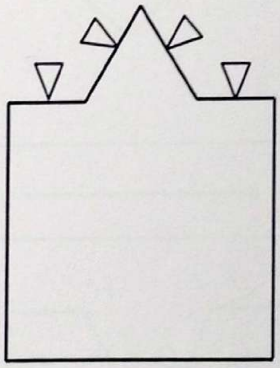
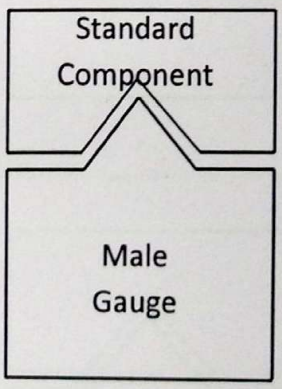
W MATERIAL SIZE: 60mm Length x 50mm Width x 5mm Thick

AWING OF THE JOB:



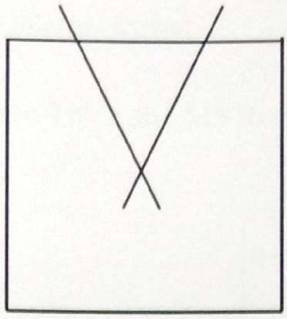
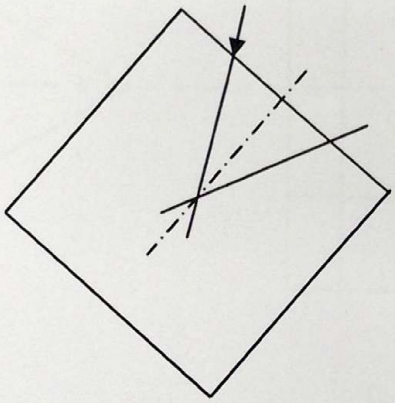
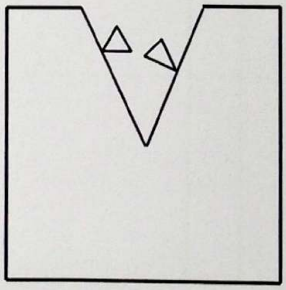
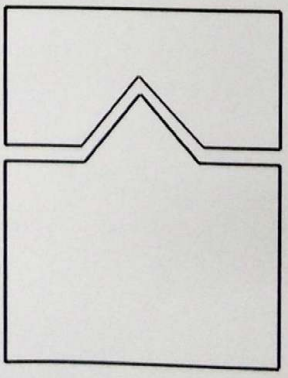
QUENCE OF OPERATION FOR MALE GAUGES:

No.	Operation	Schematic diagram	Tools required
1.	Filling, Marking and Parting off Required Length.		Scale, Try-square, scriber, Hack Saw, Prick Punch, Ball Peen Hammer
2.	Marking and Filling three edges for parallelism and squareness.		Flat file, Try-square
3.	Surface preparation for Marking.	----------	Chalk, Water
4.	Marking Construction Line as required.		Scale, Protractor, Scriber, Centre Punch, Hammer
5.	Sawing along marking lines up to required length as vertically.		Hack saw
6.	Sawing along marking lines for other side up to required length as vertically.		Hack saw

7.	Sawing the 30° inclined surface up to required length.		Hack saw
8.	Sawing the other side 30° inclined surface up to required length.		Hack saw
9.	Filling all saw-cut edges for final finishing.		Flat file
10.	Checking		Standard component

SEQUENCE OF OPERATION FEMALE GAUGES:

MECH1011

Sl. No.	Operation	Schematic diagram	Tools required
1.	Marking Construction lines as required		Scale, Protractor, Scriber, Centre Punch, Hammer.
2.	Sawing the 30° inclined surface up to required length.		Hack saw
3.	Same operation as Sl. No. 2 for the other side of V shape.	----------	Hack saw
4.	Filling all saw-cut edges for final finishing.		Flat file
5.	Checking		Standard component

JOB 2

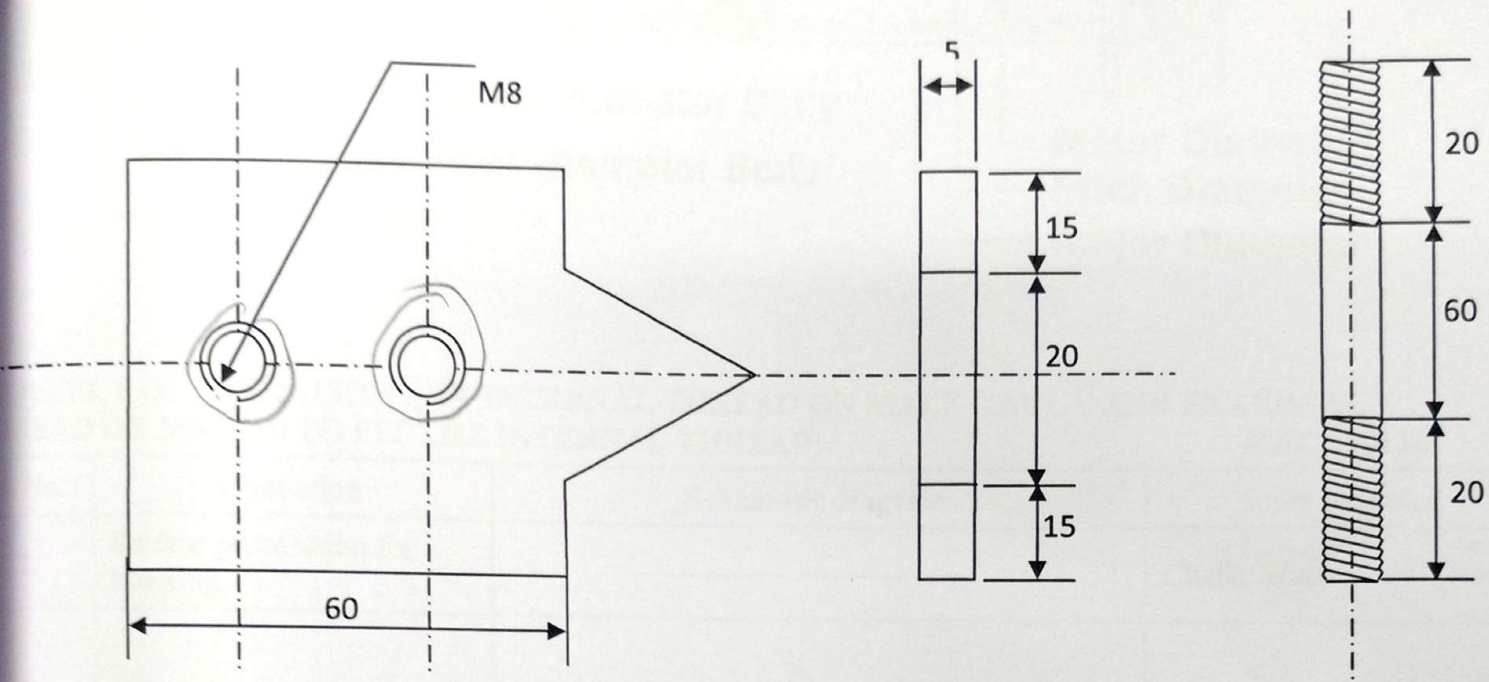
JOB NO: MECH1011/03

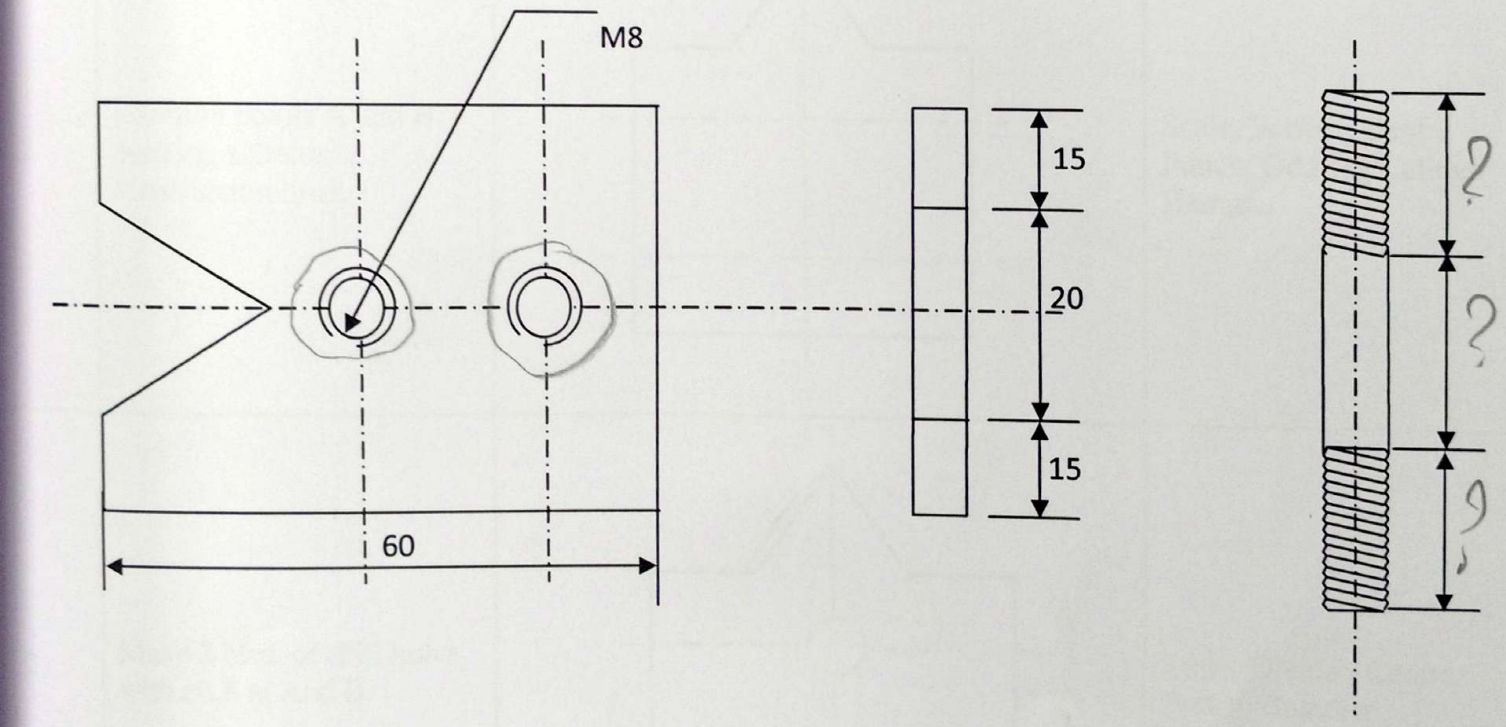
me of the Job: Making internal Threads on Male or Female Gauge plate and External thread on MS Rod to fit the internal thread.

w Materials: Mild Steel Plate and MS Rod

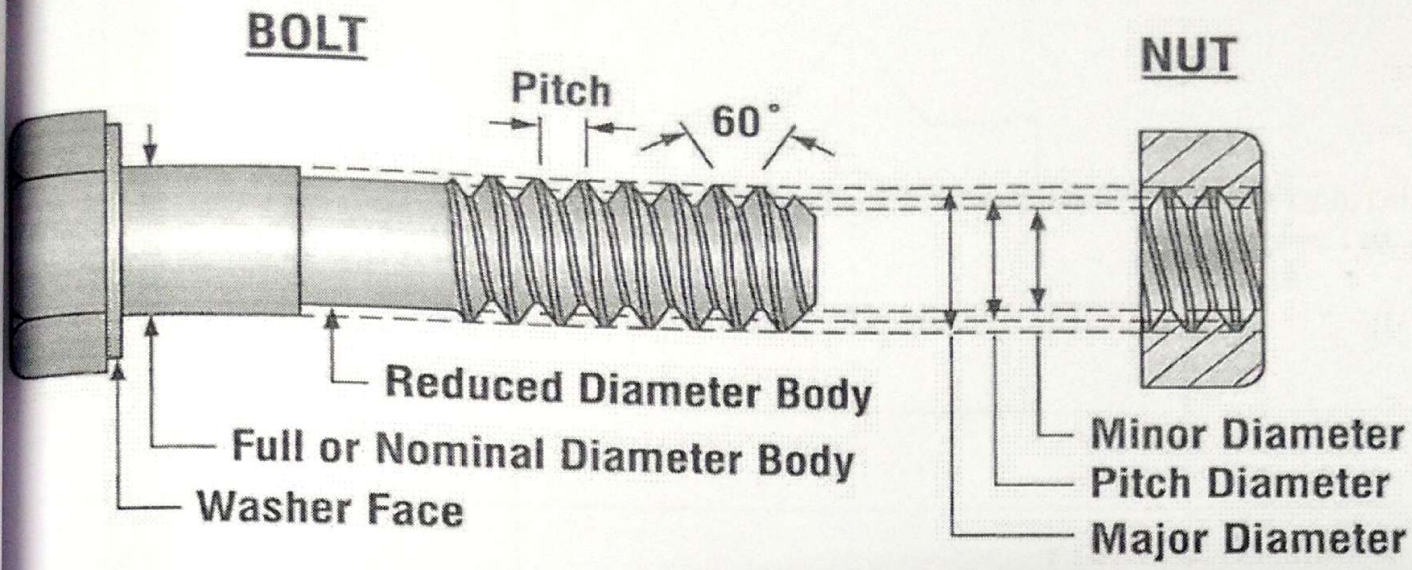
w material size: 60mm Length x 50mm Width x 5mm Thick and MS Rod of 100mm long x 8mm dia.

awing of the Job:

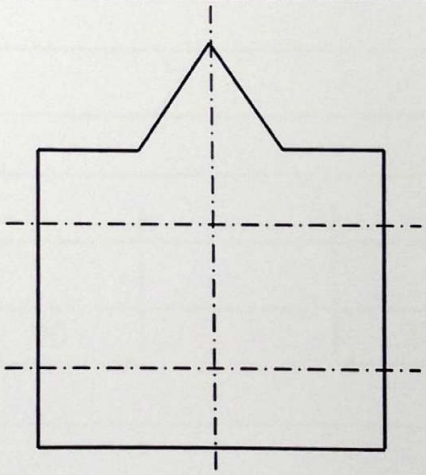
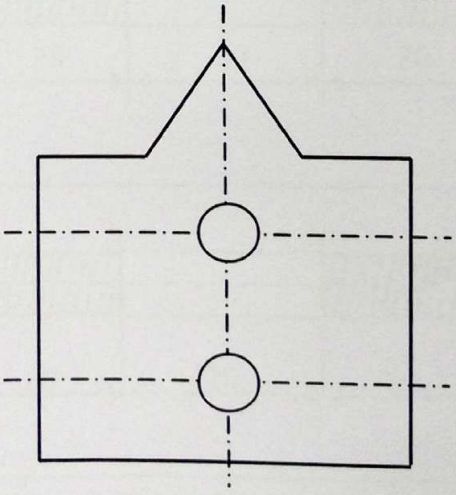


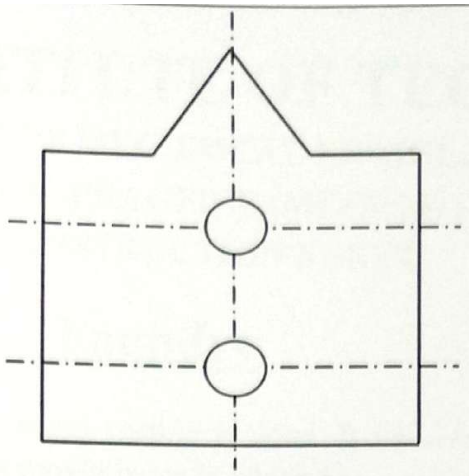
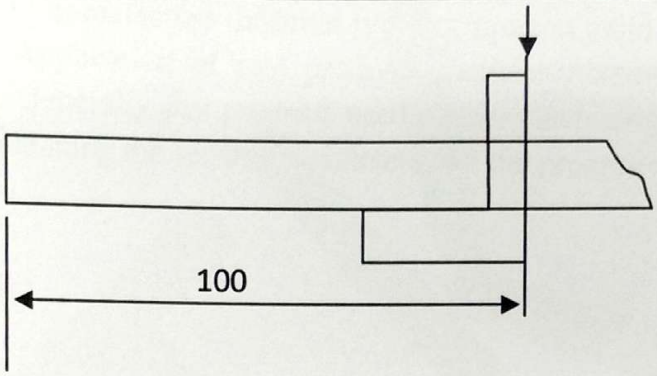
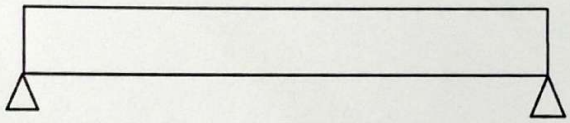
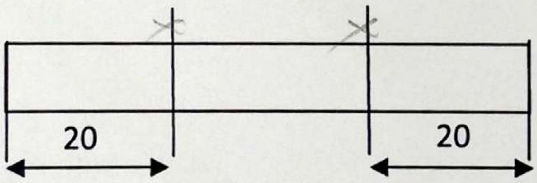
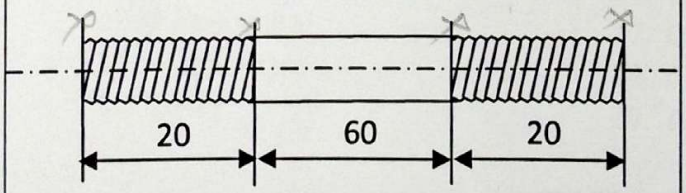
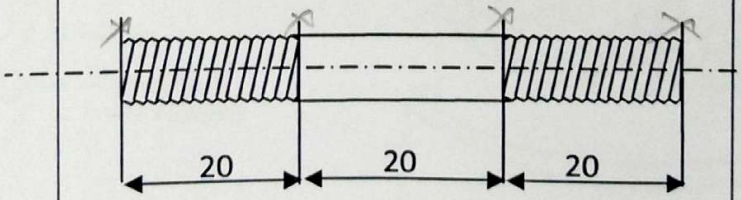


menclature of thread:



EQUENCE OF OPERATION FOR INTERNAL THREAD ON MALE GAUGE AND EXTERNAL HREAD ON MS ROD TO FIT THE INTERNAL THREAD: **MECH1011**

Sl. No.	Operation	Schematic diagram	Tools required
1.	Surface preparation for Marking.	----------	Chalk, Water
2.	Location points A and B marking suitable construction lines.		Scale, Scriber, Centre Punch, Odd-leg Caliper, Hammer
3.	Make 2 Nos. of drill holes with ø6.8 at And B.		Scale, Divider, Centre Punch, Hammer

4.	Tapping the drill hole A and B for making the internal thread of diameter 8mm.		Twist Drill, Drilling Machine, Taps and Tap wrench
5.	Filing, Marking and Parting off required length of MS Rod.		Hack saw
6.	Filing edges of the rod.		Try-square, scriber, Hack saw
7.	Marking the external thread at two ends of the rod with 20mm each.		Rough File, Try-Square.
8.	Die operation for making external thread at both end.		Die and Die-stock.
9.	Checking for thread.		By thread gauge.

SEQUESNCE OF OPERATIONS ARE SAME AS IN MALE GAUGE FOR MAKING THE INTERNAL THREAD ON FEMALE GAUGE AND FOR EXTERNAL THREAD ON MS ROD ALSO ARE SAME AS MENTION ABOVE.

HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING

WORKSHOP PRACTICE (MECH1011)

WORK INSTRUCTION SHEET

Foundry

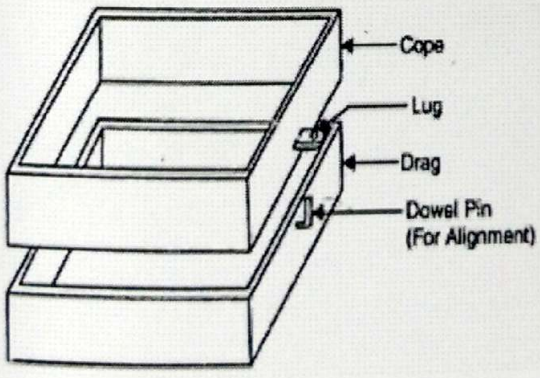
Introduction: Foundry is a shop where metal casting is done. It involves two processes, first one is moulding and then casting. In moulding a mould is made which has a cavity in which resembles the job. Molten metal is poured and then solidifies to give the product. Casting is very ancient but fundamental manufacturing process and is able to manufacture different types of product solid or hollow. For hollow products usually a core is used. Application of cast products includes homewares, engine parts of automobiles, parts of machines etc. Generally cast products need further machining operations because of several defects due to casting. By adjusting the several parameters and the process of casting these defects can be minimized or eliminated.

Some of these casting defects are

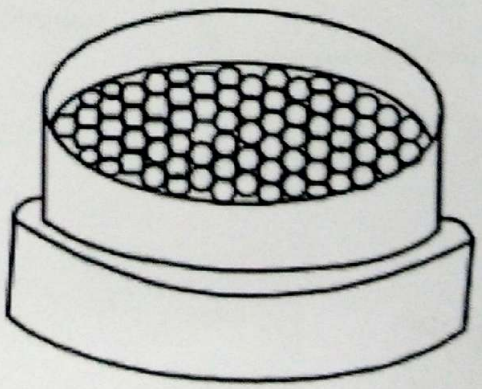
1. Blow hole
2. Porosity
3. Cold shut
4. Misrun
5. Mould shift
6. Drop
7. Fusion
8. Buckle
9. Cut or wash

Tools/equipments used

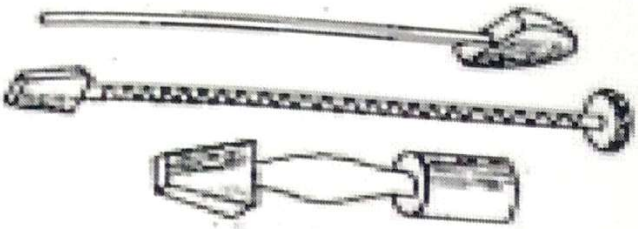
1. Flask
   a. Cope
   b. Drag
2. Pattern
3. Moulding board
4. Shovel
5. Hand riddle
6. Rammer
7. Sprue pin
8. Riser pin
9. Vent rod
10. Draw spike
11. Gate cutter
12. Lifter
13. Slick
14. Trowel
15. Muffle furnace
16. Laddle
17. Chaplet
18. Chill
19. Tong



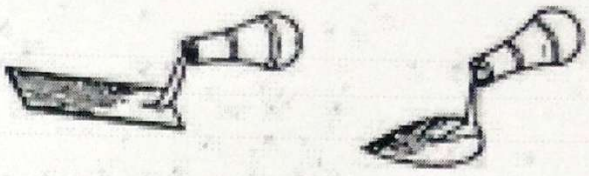
Moulding Flask



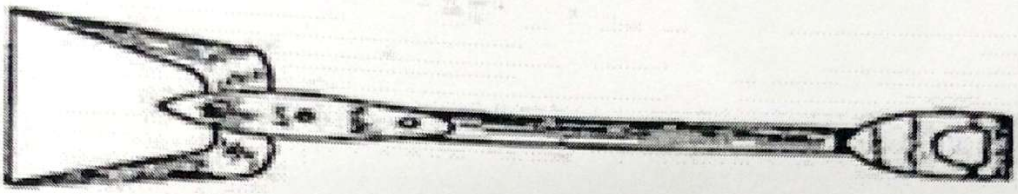
Hand Riddle



Rammer

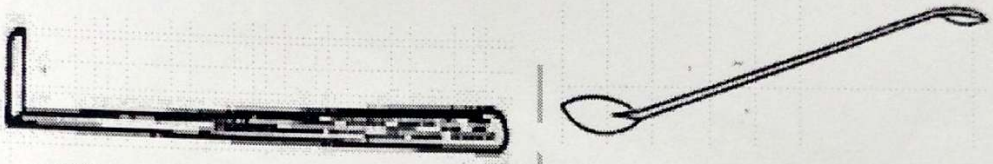


Trowl



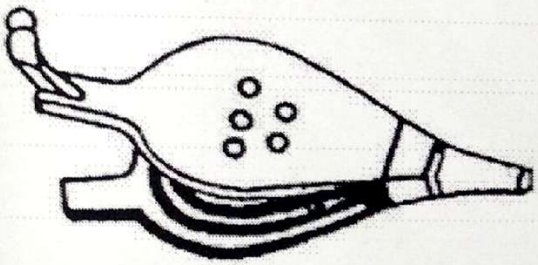
Shovel

Sprue pin

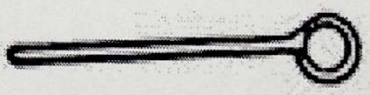


Lifter

Slick

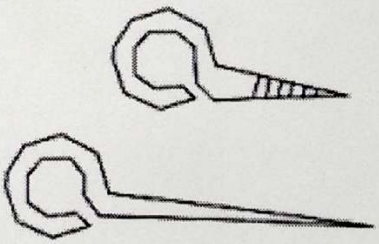


Blower

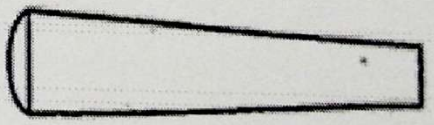


Vent rod

Gate cutter



Draw Spike



Riser pin

Muffle furnace

Laddle

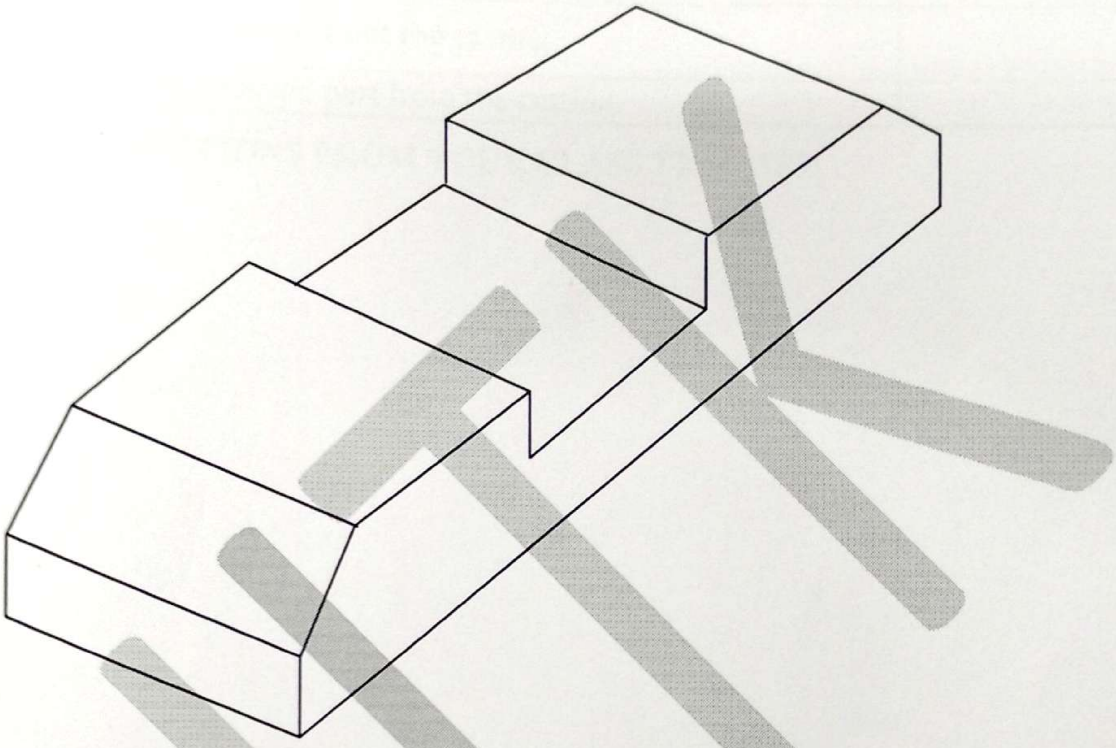
JOB 1
Job No: MECH1011/02

Name of the Job: Making of aluminum alloy casting of a given pattern

Raw Material: Alluminium Alloy

Tools Required: Pattern, Moulding Flask, Moulding Board, Rammer, Sprue Pin, Riser Pin, Shovel, Hand Riddle, Draw Spike, Vent Rod, Gate Cutter, Lifter, Slick, Trowel, Muffle Furnace, Laddle, Tong

Job diagram:



SEQUENCE OF OPERATION IN MOULDING

SL. NO.	SEQUENCE	TOOLS USED
1.	Preparation of green sand.	Hand riddle, shovel
2.	Place the drag on the moulding board in inverted position	Moulding board, Drag
3.	Placing the pattern at the centre of the moulding flask	
4.	Filling the drag with green sand.	Shovel
5.	Ramming the drag.	Rammer
6.	Reversing the drag so that mould cavity comes upward.	
7.	Placing the cope on the top of drag	
8.	Placing sprue pin and riser pin in suitable position in the cope.	Sprue pin, riser pin.
9.	Filling the cope with green sand.	Shovel
10.	Ramming the cope.	Rammer
11.	Making the vents.	Vent rod
12.	Removal of the pattern, sprue and riser pin.	Draw spike
13.	Making of gating system and pouring basin	Gate cutter
14.	Finishing of mould cavity	Lifter, slick, trowel

SEQUENCE OF OPERATION IN CASTING

SL. No.	SEQUENCE	TOOLS USED
15.	Melt the metal in Muffle furnace.	Muffle furnace
16.	Take the molten metal in ladle.	Ladle
17.	Pour into the mould cavity.	Ladle
18.	Wait for solidification.	
19.	Break the mould and bring out the casting.	
20.	Machine out the finished part from the casting.	

GET DETAIL INSTRUCTIONS FROM YOUR CLASS TEACHER

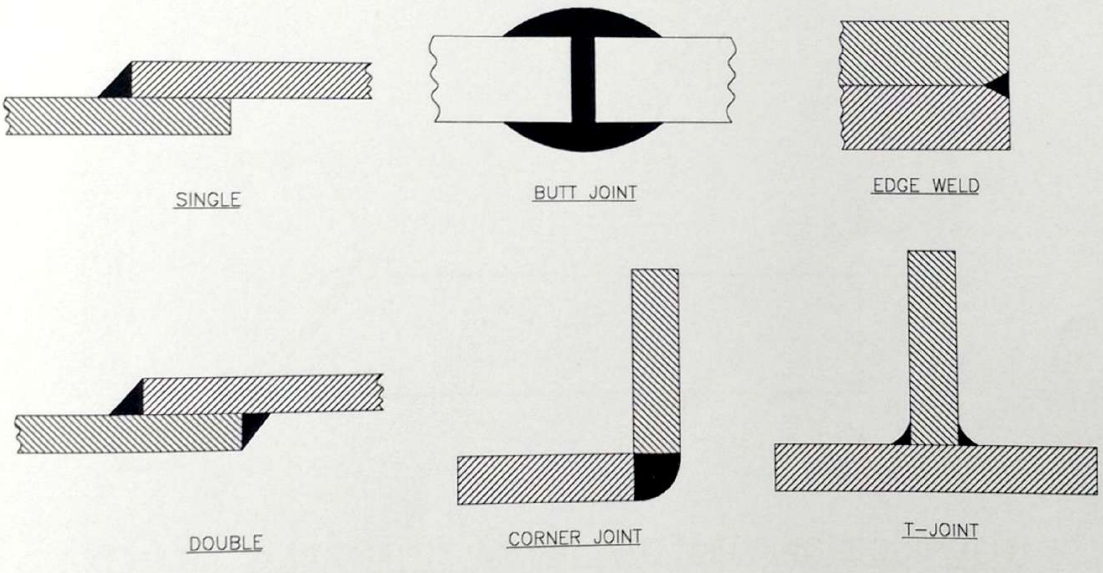
HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING
WORKSHOP PRACTICE (MECH1011)
WORK INSTRUCTION SHEET

Welding

Welding is defined as a joining process that produces coalescence of materials by heating them to the welding temperature, with or without the application of pressure or by the application of pressure alone, and with or without the use of filler metal. Welding is employed in various applications such as construction of Ships, buildings, bridges fabrication.

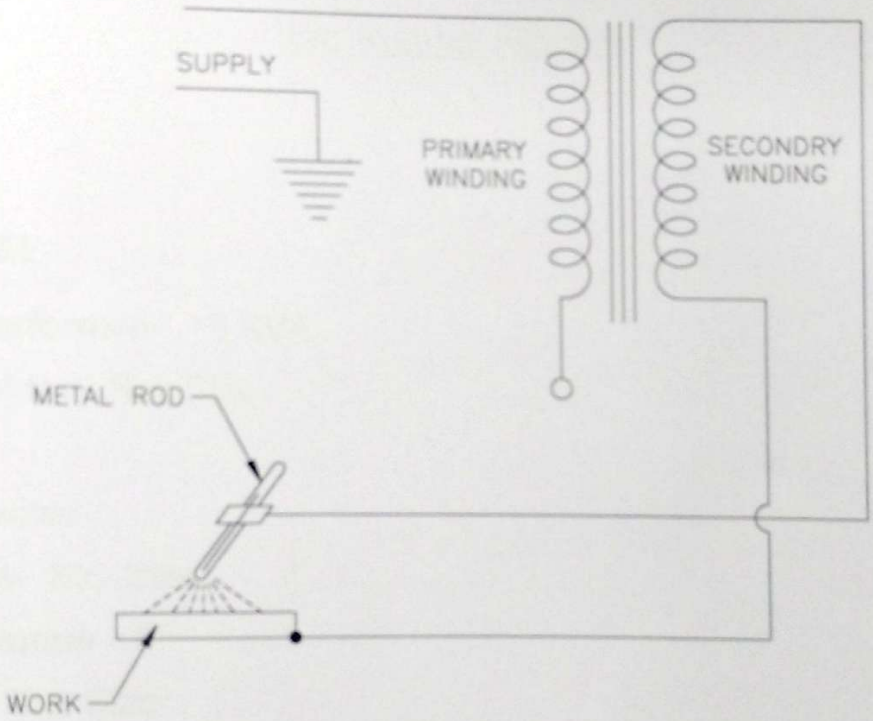
Manual metal arc welding and gas welding are the two types of welding in which heat sources are electric arc and combustion of gases respectively. Welding can joint different types of materials in different orientation.



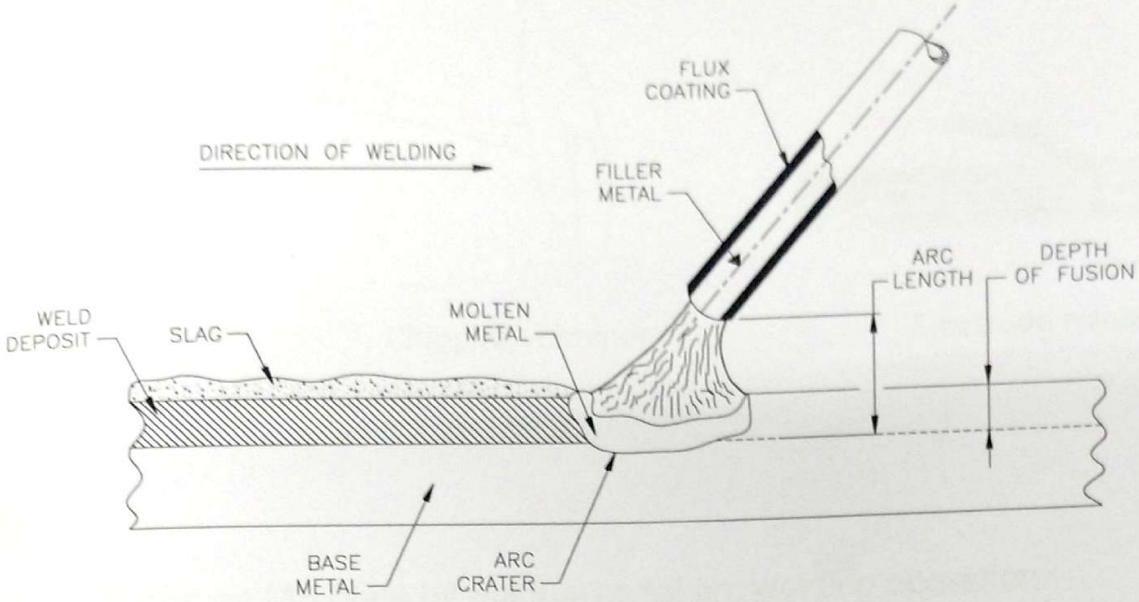
WELDED JOINTS

Manual metal arc welding:

In metal arc welding a metal rod is used as one electrode (consumable) while the work being melted is used as another electrode. The arc is formed between the work and the electrode. Temperature around 3600° centigrade is generated. Molten metal is deposited in the joint and coalesces to form the joint.



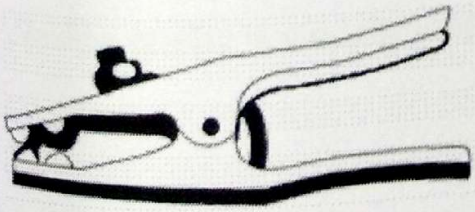
SKEMATIC DIAGRAM OF METAL ARC WELDING EQUIPMENT



ARC WELDING PROCESS

Arc welding equipments

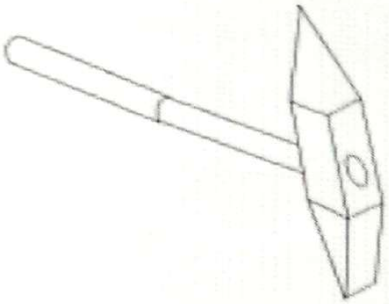
1. **Welding transformer-** 13 KVA
2. **Electrode holder-** Std. Size
3. **Cable**
4. **Cable Connector**
5. **Earth clamps-** Std. Size
6. **Chipping hammer** - 6"
7. **Face shield-** Std. Size
8. **Hand gloves-** Std. Size



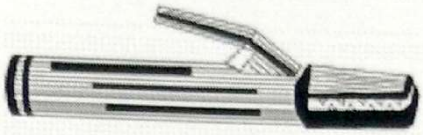
Earth clamp

Hand gloves

Face shield



Chipping Hammer



Electrode holder

Name of the job

To prepare a butt joint on MS plate by manual metal arc welding operation

Raw material used

Mild steel plate, 6 mm thick.

Sequence of operation

1. Edge preparation:

   To obtain sound welds, good edge preparation is a prerequisite. This involves suitably beveling the edges, and carefully cleaning the faces to be welded from dust, sand, oil and grease. For 6 mm thick plate single-V edge preparation is done.

2. Make the job ready for welding by bringing prepared faces together.
3. Adjust voltage and current in the welding machine.
4. Select electrode (3.15 mm dia. For 6 mm plate).
5. Put on personal safety equipments.
6. Put the job on the table which is connected with earth clamp.
7. Insert the electrode in the electrode holder.
8. Turn on the welding power source.
9. Strike out by bringing electrode near the groove of the job and then slowly move electrode along groove to continue welding.

Testing and quality control

Welding quality is visually inspected after chipping the top surface of the weld.

HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING
WORKSHOP PRACTICE (MECH1011)
WORK INSTRUCTION SHEET

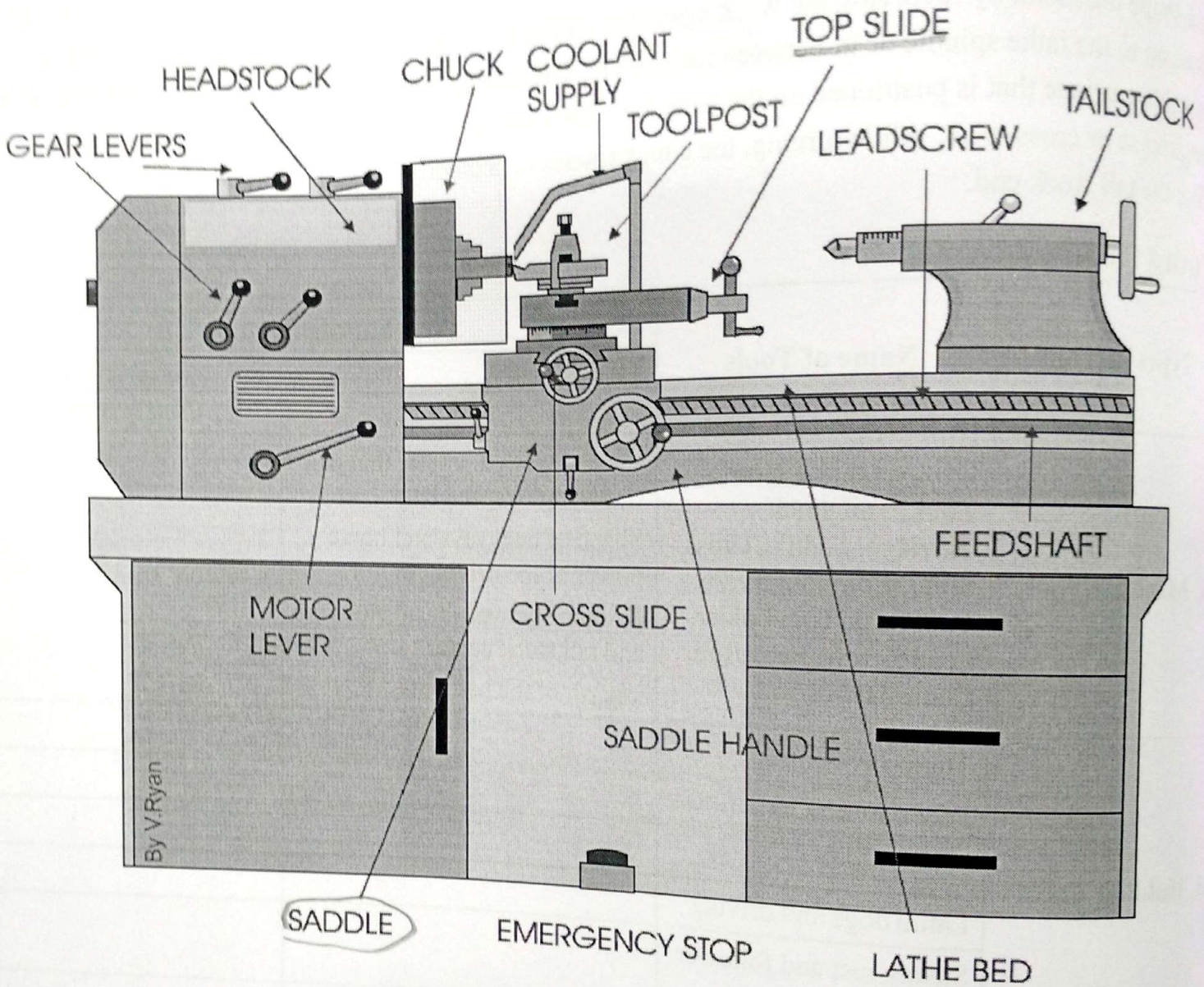
MACHINE SHOP

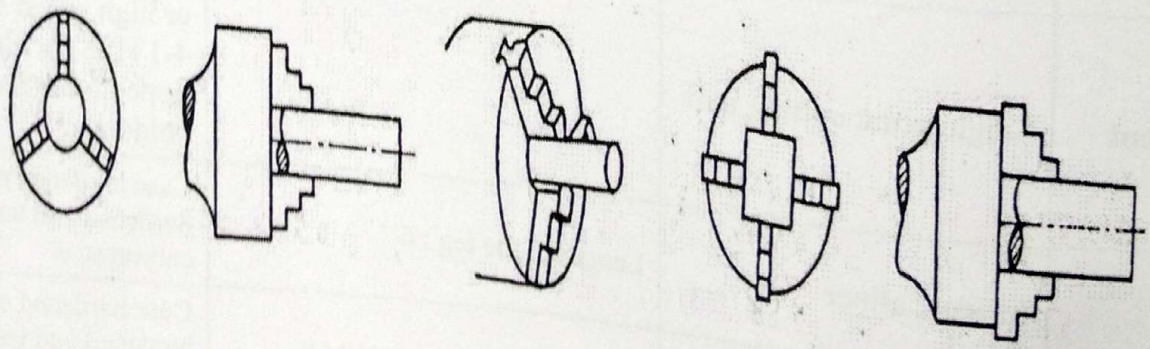
Introduction: In a machine shop, metals are cut to shape on different machine tools. A lathe is used to cut and shape the metal by revolving the work against a cutting tool. The work is clamped either in a chuck, fitted on to the lathe spindle or in-between the centers. The cutting tool is fixed in a tool post, mounted on a movable carriage that is positioned on the lathe bed. The cutting tool can be fed on to the work, either lengthwise or cross-wise. While turning, the chuck rotates in counter-clockwise direction, when viewed from the tail stock end.

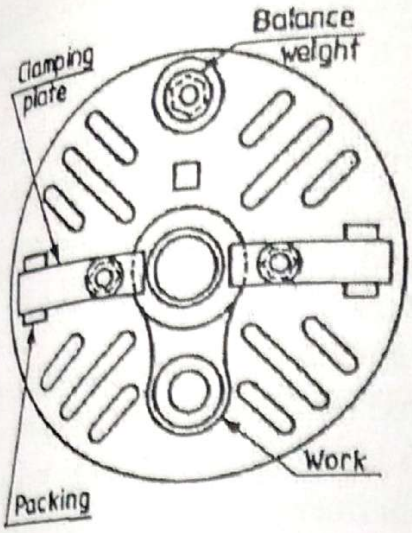
TOOLS USED:

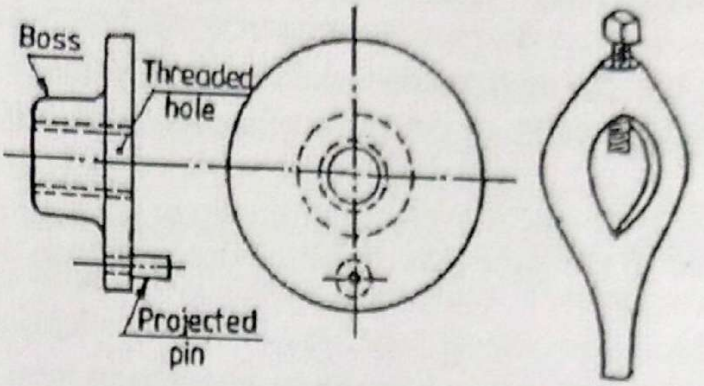
Types of Tool	Name of Tools	Specification	
		Size	**Materials of Construction**
A. Machine Tool	Centre Lathe (Head stock, Tail stock, Carriage, Saddle, Cross Slide, Compound rest, Tool post, Tool holder, Lead Screw, Feed Rod, Centre's)	Largest work diameter that can be swung over the lathe bed. Shape of bed ways and horse power of the driving motor. Distance between head stock and tail stock center. Length of the bed.	Cast Iron Body,
B. Holding Tools	Three Jaw Chuck		
	Four Jaw Chuck		
	Face Plate		
	Lathe dogs and driving		
	Steady rest and follower rest		
C. Cutting Tool	Single point cutting tool		Carbon steel or tool steel or high speed steel (18-4-1 HSS) or Carbide tipped tools fixed in tool holders
D. Measuring Tool	Inside Caliper	Length of the leg : 6''	Case hardened mild steel or hardened and tempered low carbon steel
	Outside Caliper	Length of the leg : 12'' / 6''	Case hardened mild steel or hardened and tempered low carbon steel
	Vernier Caliper	Range : 0-150mm Least count:0.01mm	Stainless Steel, Carbide tipped Jaws

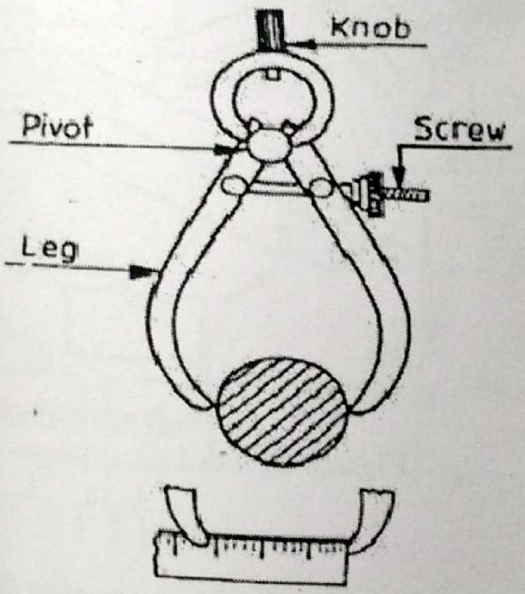
	Micrometer	Range: Graduation / Resolution: Dial / Analog / Direct Reading Scale	
	Steel Rule	Maximum measureable length Least Count	Stainless Steel



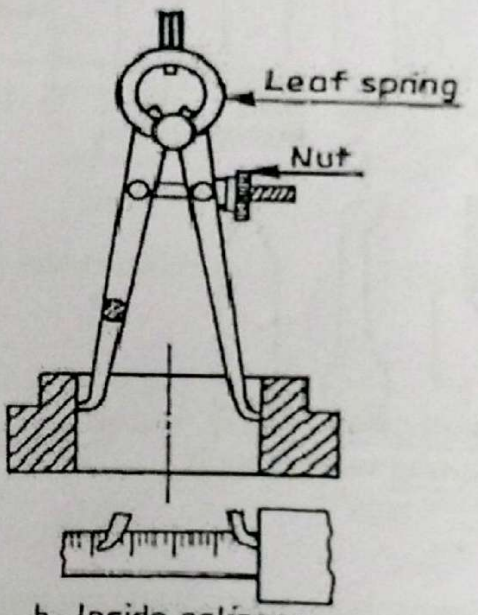




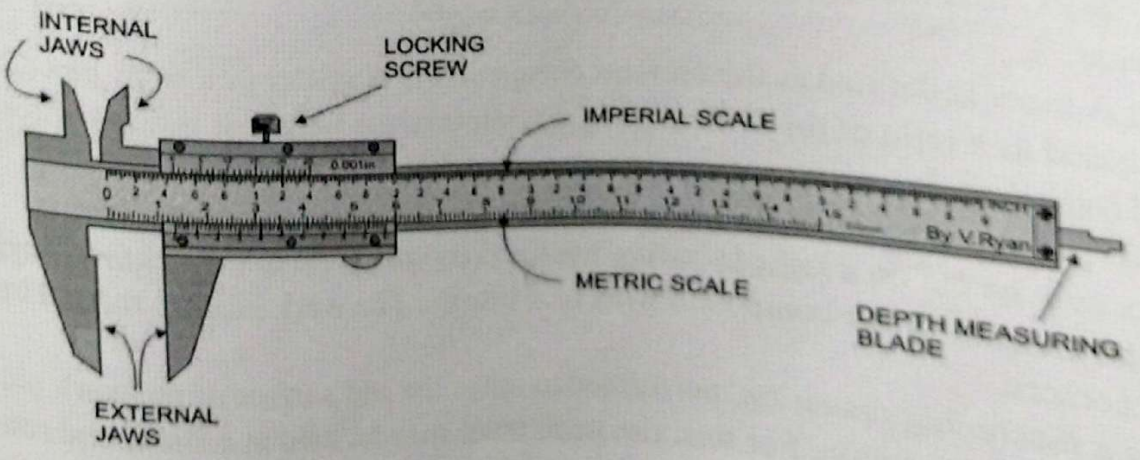




a-Outside calipers



b-Inside calipers



CUTTING PARAMETERS

I. **Cutting Speed:** It is defined as the speed at which the material is removed and is specified in meters per minute. Ti depends upon the work piece material, feed, depth of cut, type of operation and so many other cutting conditions. It is calculated from the relation,

Spindle speed (RPM) = cutting speed x 1000 / (πD) Where D is the work piece diameter in mm.

II. **Feed Rate:** It is the distance traversed by the tool along the bed, during one revolution of the work. Its value depends upon the depth of cut and surface finish of the work desired.

III. **Depth of Cut:** It is the movement of the tip of the cutting tool, from the surface of the work piece and perpendicular to the lathe axis. Its value depends upon the nature of operation like rough turning or finish turning.

CUTTING TOOL GEOMETRY: A single point cutting tool used on lathe may be considered as a simple wedge.

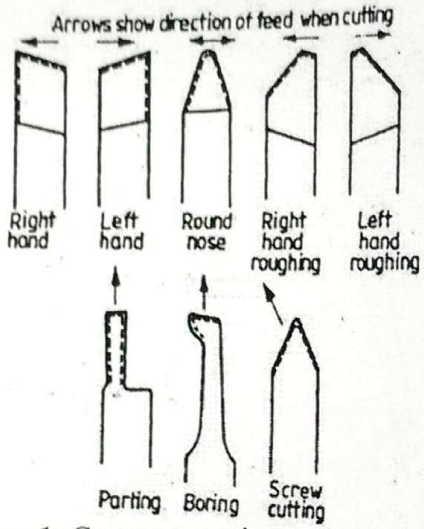


Figure 1: Common turning tools

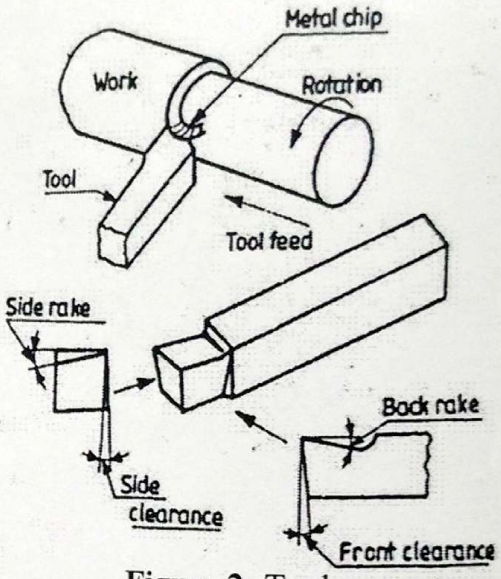


Figure 2: Tool geometry

LATHE OPERATIONS

I. **Turning:** Cylindrical shapes, both external and internal, are produced by turning operation. Turning is the process in which the material is removed by a traversing cutting tool, from the surface of a rotating work piece. The operation used for machining internal surfaces is often called the boring operation in which a hole previously drilled is enlarged.
For turning long work, first it should be faced and center drilled at one end and then supported by means of the tail-stock centre.

II. **Taper Turning:** A taper is defined as the uniform change in the diameter of a work piece, measured along its length. It is expressed as a ratio of the difference in diameters to the length. It is also expressed in degrees of half the included (taper) angle.
Taper turning refers to the production of a conical surface, on the work piece on a lathe.
Short steep tapers may be cut on a lathe by swiveling the *compound rest* to the required angle. Here, the cutting tool is fed by means of the compound slide feed handle. The work piece is rotated in a chuck or face plate or between centers.

III. **Facing:** Facing is a machining operation, performed to make the end surface of the work piece, flat and perpendicular to the axis of rotation. For this, the work piece may be held in a chuck and rotated about the lathe axis. A facing tool is fed perpendicular to the axis of the lathe. The tool is slightly inclined towards the end of the work piece.

IV. **Boring:** Boring is enlarging a hole and is used when correct size drill is not available. However, it should be noted that boring cannot make a hole.

V. **Drilling:** Holes that are axially located in cylindrical parts are produced by drilling operation, using a twist drill. For this, the work piece is rotated in a chuck or face plate. The tail stock spindle has a standard taper. The drill bit is fitted into the tail stock spindle directly or through drill chuck. The tail stock is then moved over the bed and clamped on it near the work. When the job rotates, the drill bit is fed into the work by turning the tail stock hand wheel.

VI. **Knurling:** It is the process of embossing a diamond shaped regular pattern on the surface of a work piece using a special knurling tool. This tool consists of a set of hardened steel rollers in a holder with the teeth cut on their surface in a definite pattern. The tool is held rigidly on the tool post and the rollers are pressed against the revolving work piece to squeeze the metal against the multiple cutting edges. The purpose of knurling is to provide an effective gripping surface on a work piece to prevent it from slipping when operated by hand.

VII. **Threading:** Threading is nothing but cutting helical groove on a work piece. Threads may be cut either on the internal or external cylindrical surfaces. A specially shaped cutting tool, known as thread cutting tool, is used for this purpose. Thread cutting in a lathe is performed by traversing the cutting tool at a definite rate, in proportion to the rate at which the work revolves.

VIII. **Chamfering:** It is the operation of beveling the extreme end of a work piece. Chamfer is provided for better look, to enable nut to pass freely on threaded work piece, to remove burrs and protect the end of the work piece from being damaged.

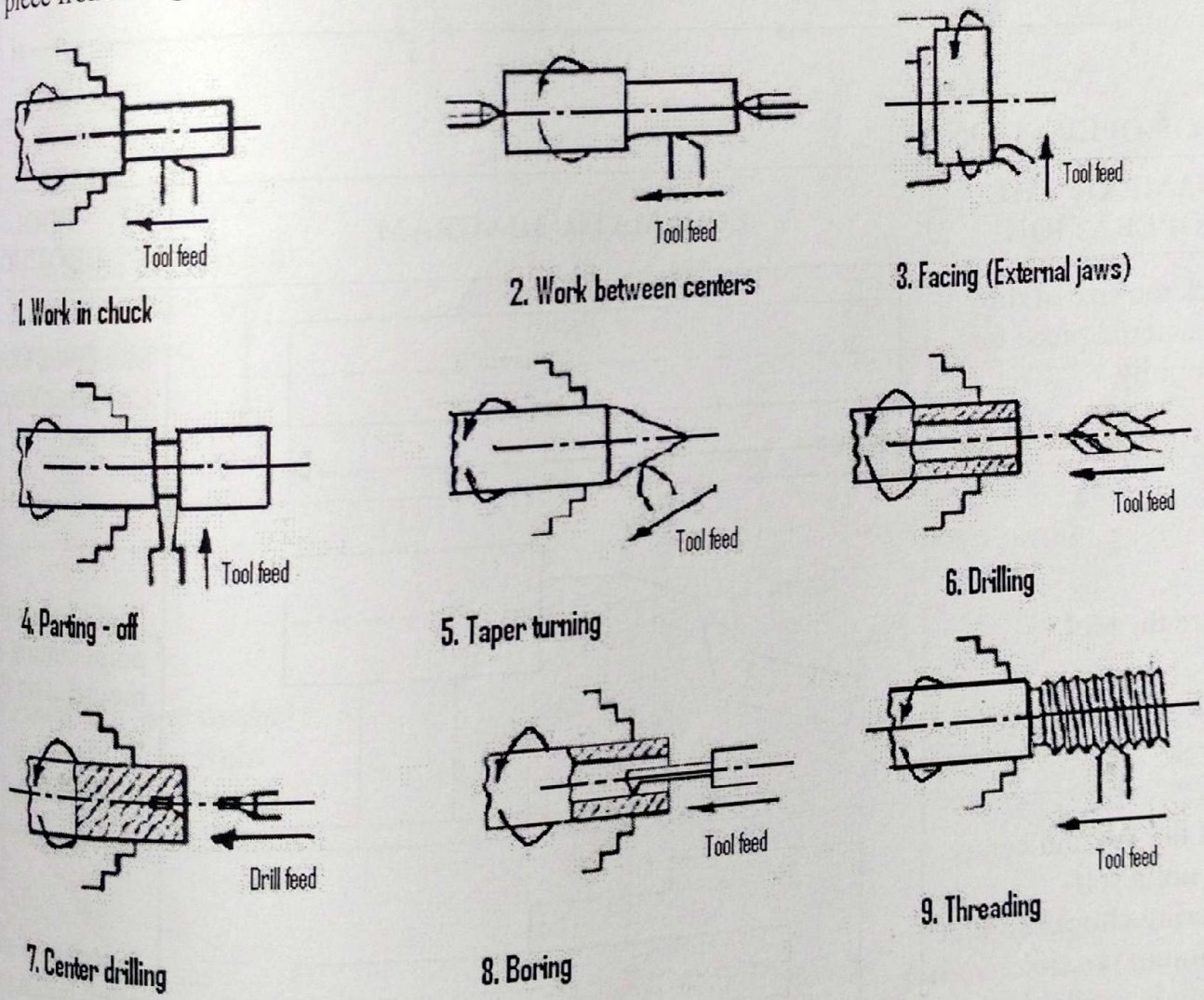


Figure 3: Operations of Lathe

JOB 1

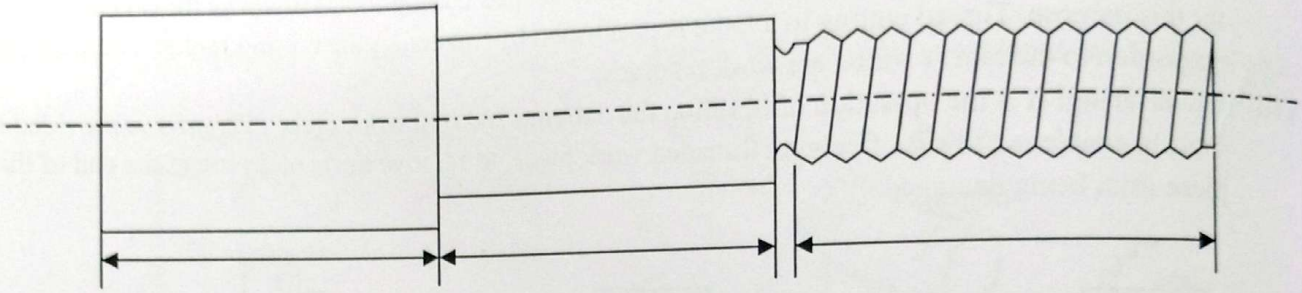
Name of the Job: Making of a stepped Pin with thread at one end on a MS bar

Raw Materials: Mild steel bar.

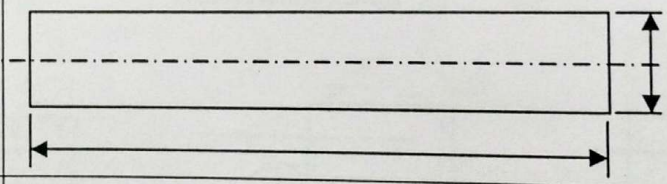
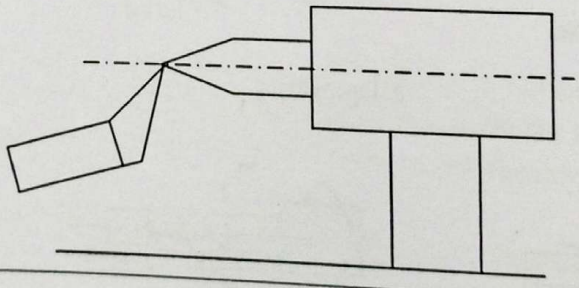
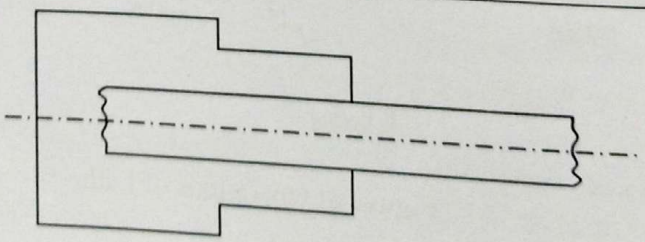
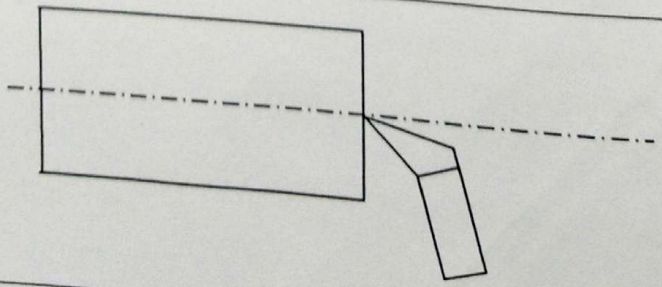
Raw material size: Mild steel bar of 35mm diameter and 120mm length.

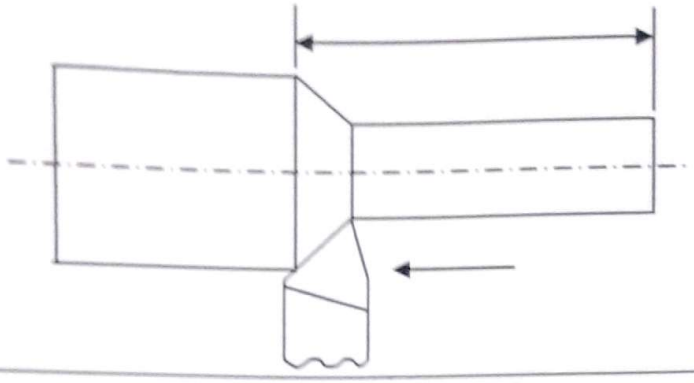
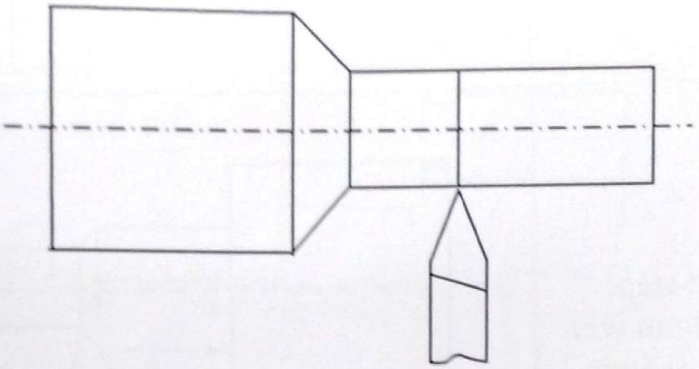
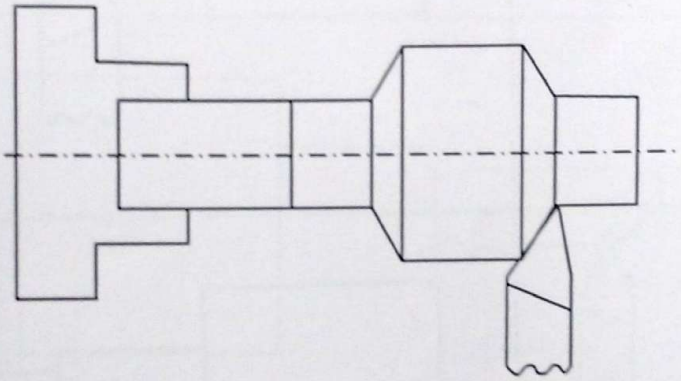
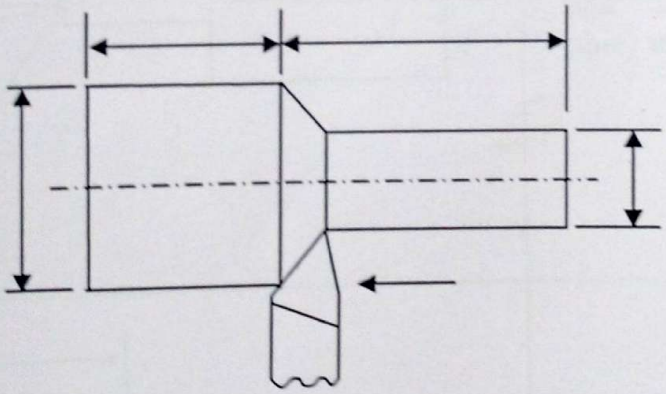
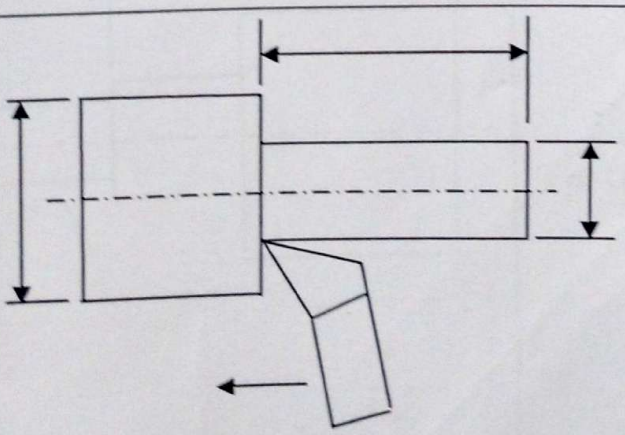
Tools Required: Lathe machine, Mild steel bar, right hand cutting tool, box key or tool post key, chuck key, steel rule, Vernier caliper, outside calipers.

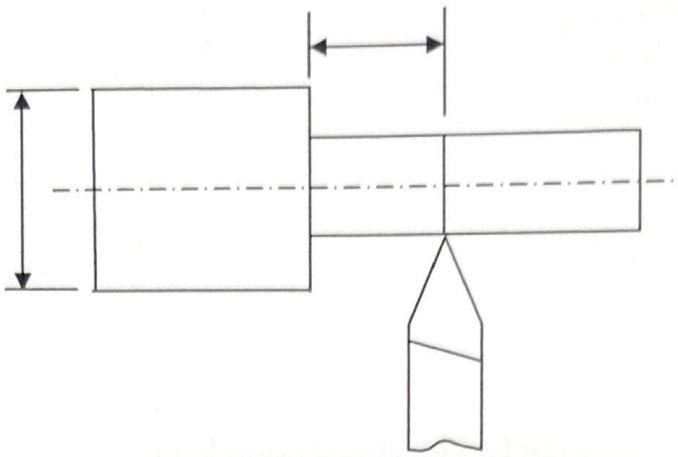
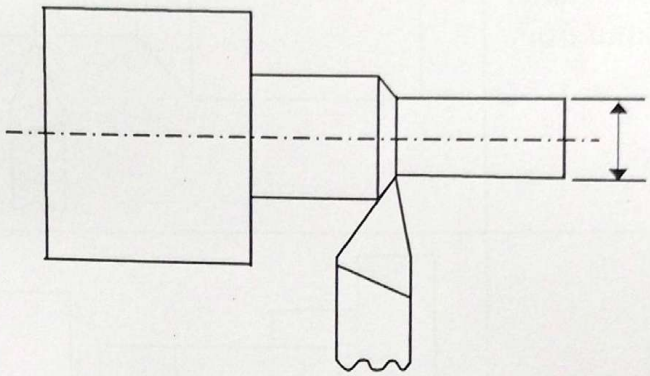
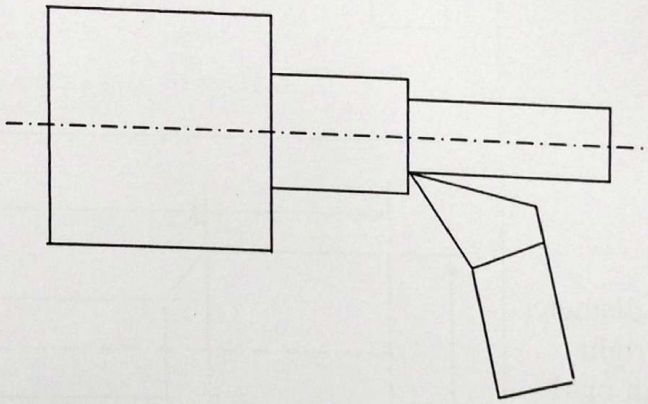
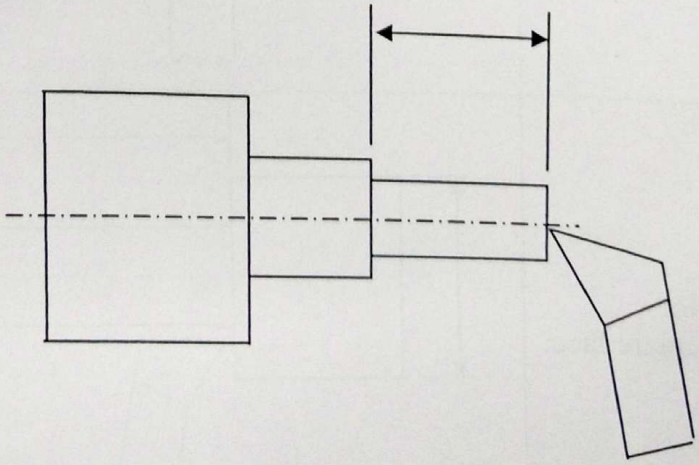
Drawing of the job:

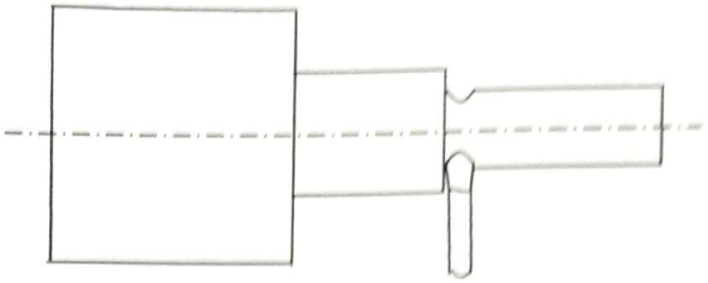
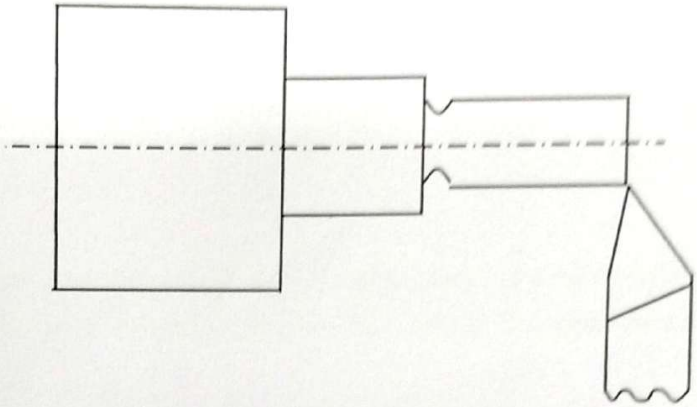
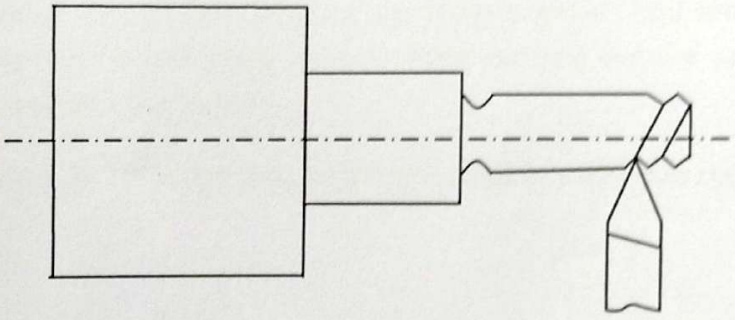


SEQUENCE OF OPERATION:

SL. NO.	NAME OF THE OPERATION	SCHEMATIC DIAGRAM	TOOLS REQUIRED
1.	Check the size of the raw material piece for conformity.		Steel rule, Outside Calipers, Vernier Caliper.
2.	Centre the tool		Right hand single point cutting tool mounted on the tool post.
3.	Hold the job and centre it (if not a self-centering chuck) so that maximum possible. Length is available for machining.		Right hand single point cutting tool, Surface gauge.
4.	Face the right end surface by about 2-3mm.		Right hand single point cutting tool.

5.	Make straight turning with 1mm + 1mm + 0.5mm cut in steps up to maximum length to make the finish diameter of 30mm.		Right hand single point cutting tool.
6.	Make a round mark with the tool at an axial distance of 30mm from the right end.		Right hand single point cutting tool.
7.	Dismantle the job and hold it the other way on 30mm finished diameter.		Right hand single point cutting tool.
8.	Finish the step diameter to 25mm from right end up to the cut mark as in step 5.		Right hand single point cutting tool.
9.	Face side B for obtaining a square face.		Right hand single point cutting tool.

10.	Make a round mark with the tool at an axial distance of 30mm from the left end of 25mm diameter step.		Right hand single point cutting tool.
11.	Finish the next step diameter to 20mm with 1mm +1mm + 0.5mm cut in steps.		Right hand single point cutting tool.
12.	Square face the junction of the 2nd and 3rd step diameter (side C).		Right hand single point cutting tool.
13.	Face the side D to make length of CD to 40mm.		Right hand single point cutting tool.

4.	Make a half round notch on 20mm diameter of a width of 5mm, starting from 25mm diameter step.		Right hand single point cutting tool.
5.	Finish the 3rd step diameter to 19mm by auto feed.		Right hand single point cutting tool.
6.	Adjust the feed to cut 10TPI thread on the 19mm diameter portion for a length of 35mm from right end and make the teeth cutting by adjusting the cut in 2-3 steps.		Right hand single point cutting tool.

HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING

WORKSHOP PRACTICE (MECH1011)

WORK INSTRUCTION SHEET

SHAPING

Shaping

Shaping is a simple cutting operation by which flat surfaces, grooves and notches can me machined by a cutting tool which undergoes linear reciprocating motion while the workpiece is provided necessary feed motion.

The cutting tool used for shaping is single point cutting tool which is given reciprocating motion normally through **quick return mechanism** and the job fixed to the table is given feed motion. There are also other mechanisms to provide this reciprocating motion. Feed motion can be provided manually or automatically with **pawl and ratchet mechanism**.

Usually for small jobs shaper is used. For larger jobs planning is used in which job reciprocates and tool is given feed motion.

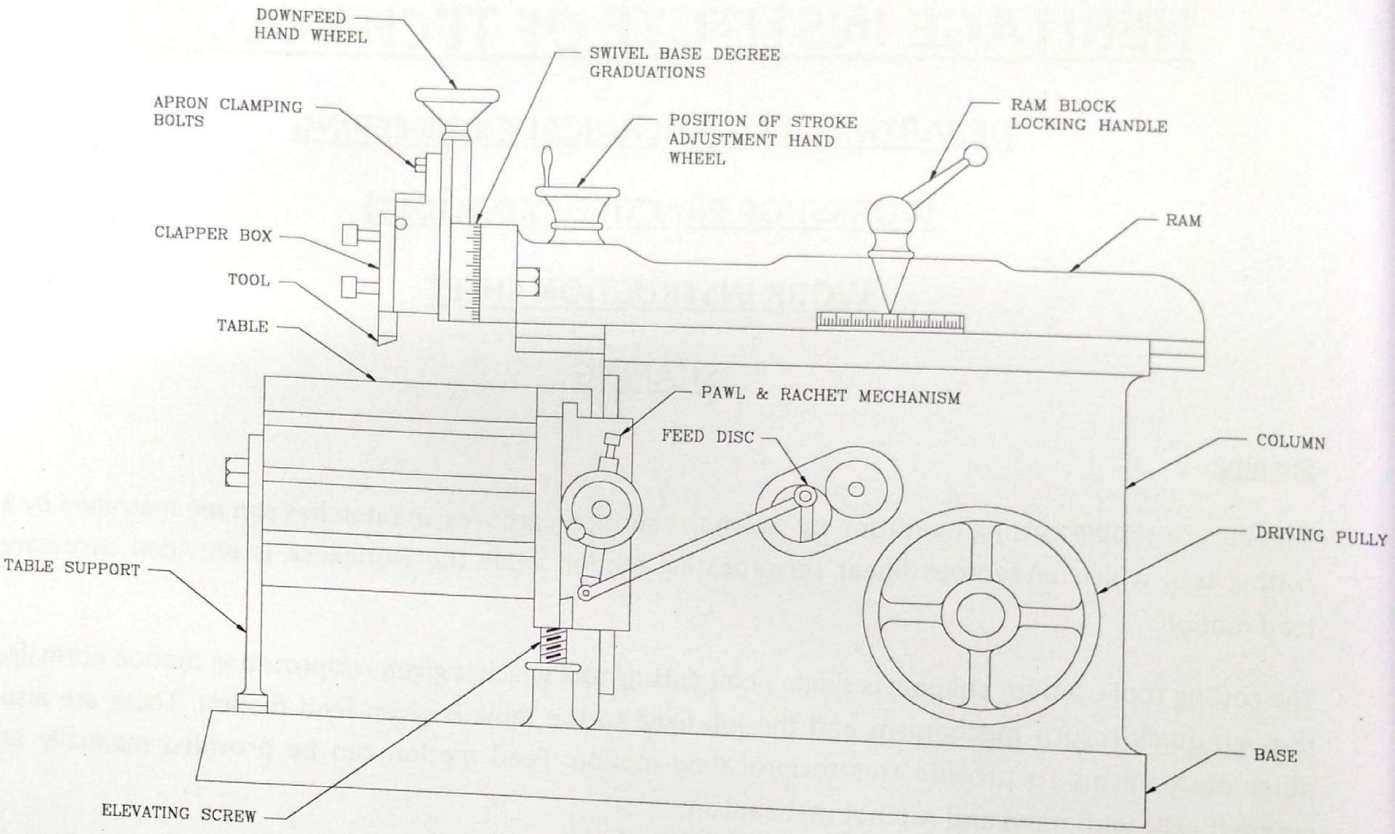
Machine tool used:

Shaper

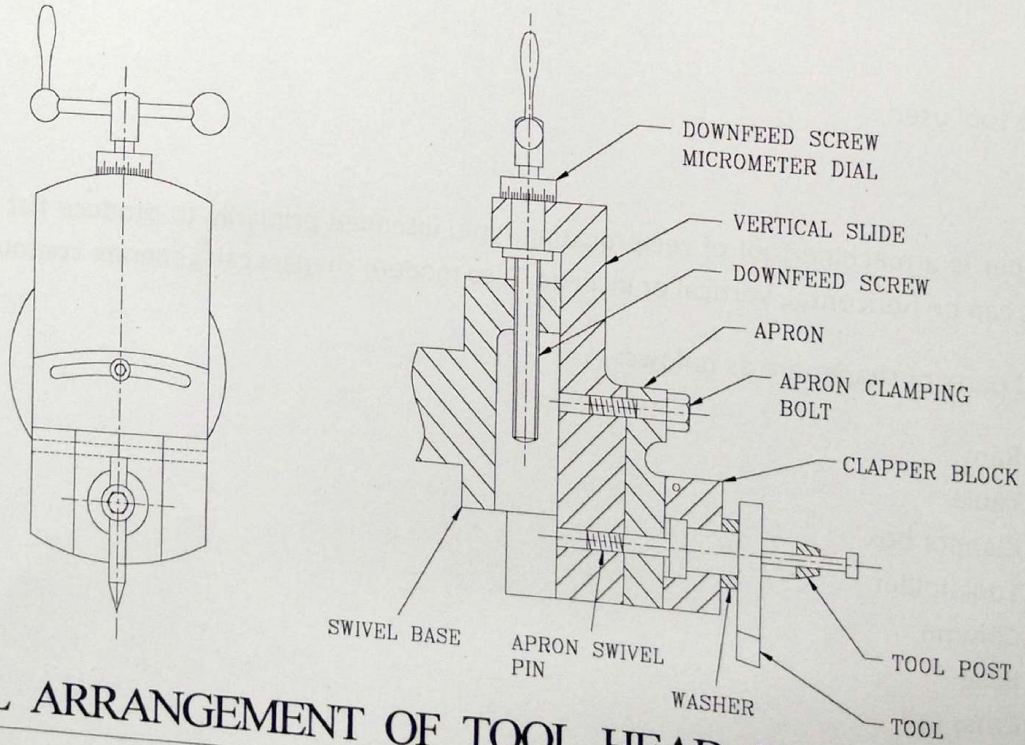
The shaper is a machine tool of reciprocating type, intended primarily to produce flat surfaces. These surfaces can be horizontal, vertical or inclined. Also modern shapers can generate contoured surfaces.

Principal parts of shaper are as follows:

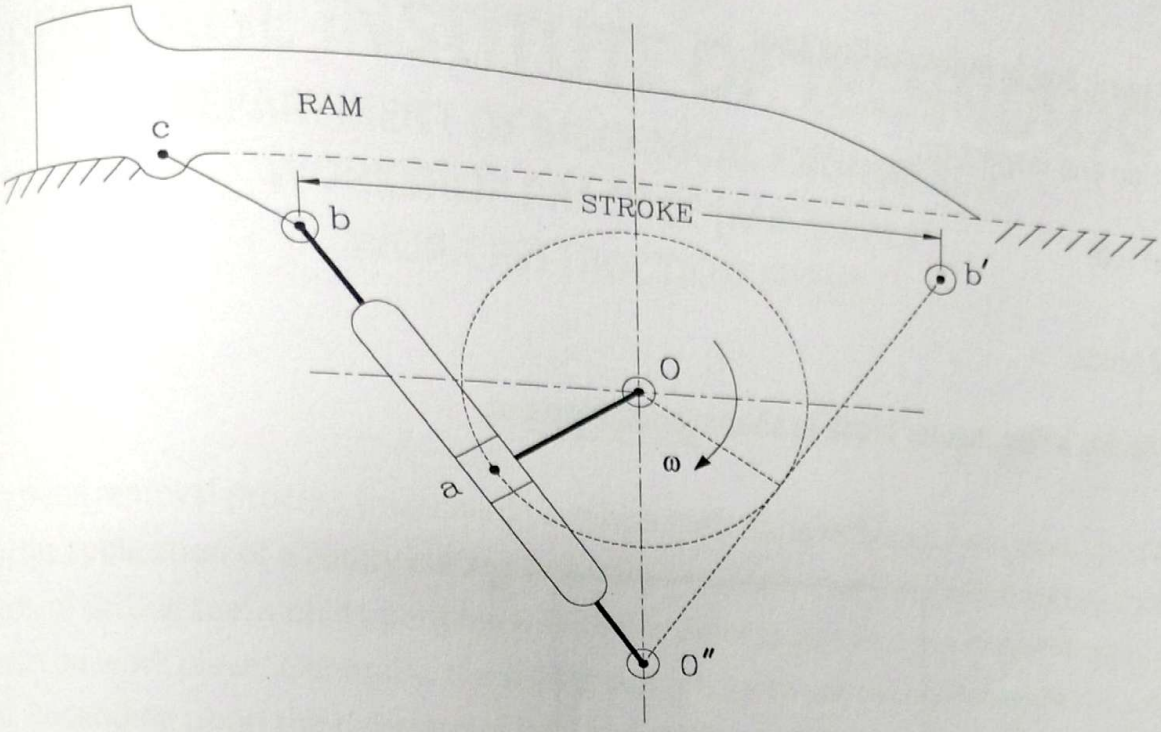
1. Ram
2. Table
3. Clapper box
4. Tool holder
5. Column
6. Base
7. Cross rail
8. Table support



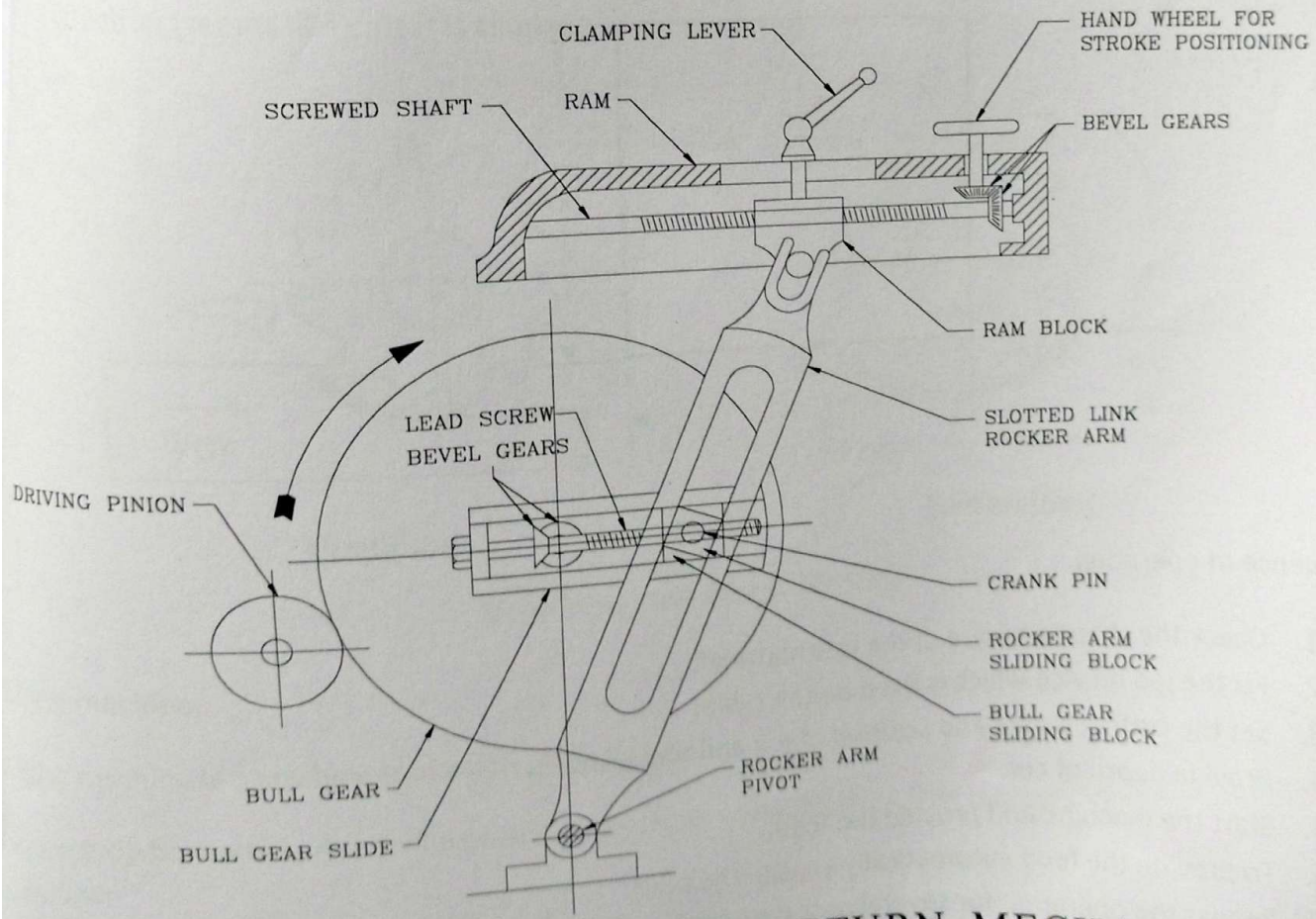
A TYPICAL ARRANGEMENT OF SHAPING MACHINE



A TYPICAL ARRANGEMENT OF TOOL HEAD SHAPING MACHINE



SCHEMATIC DIAGRAM OF SLOTTED ARM QUICK RETURN MECHANISM



OSCILLATING ARM QUICK RETURN MECHANISM

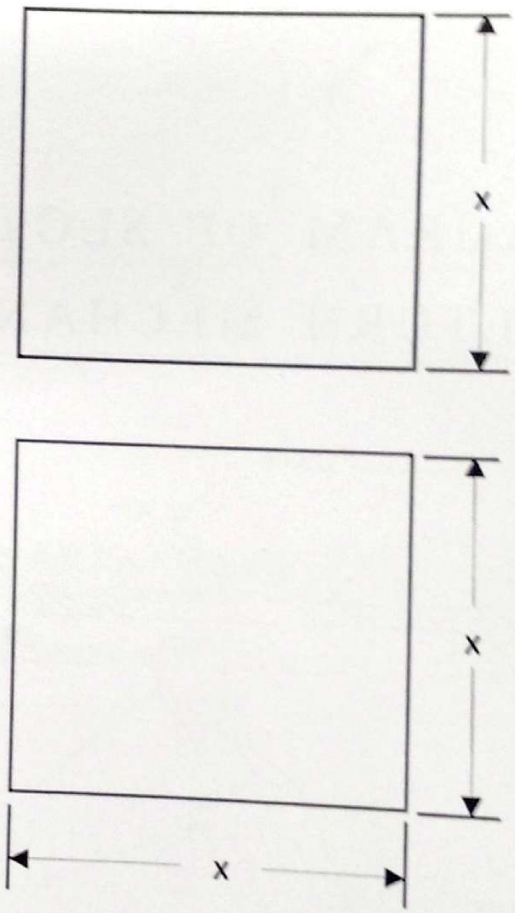
Cutting tool used: **Single point cutting tool**

Tools for set-up and inspection:

1. Steel rule
2. Vice
3. Tool holder

Job name: Making a rectangular block in shaping machine out.

Job diagram:



Sequence of operation

1. Check the shape and size of the raw material.
2. Fix the job on vice which is fixed on the table.
3. Set the cutting stroke and position of job and tool properly.
4. Provide depth of cut.
5. Start the machine and provide the feed.
6. To provide the feed automatically engage the pawl.
7. Repeat the operation for several pass until the required job is ready.

HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING

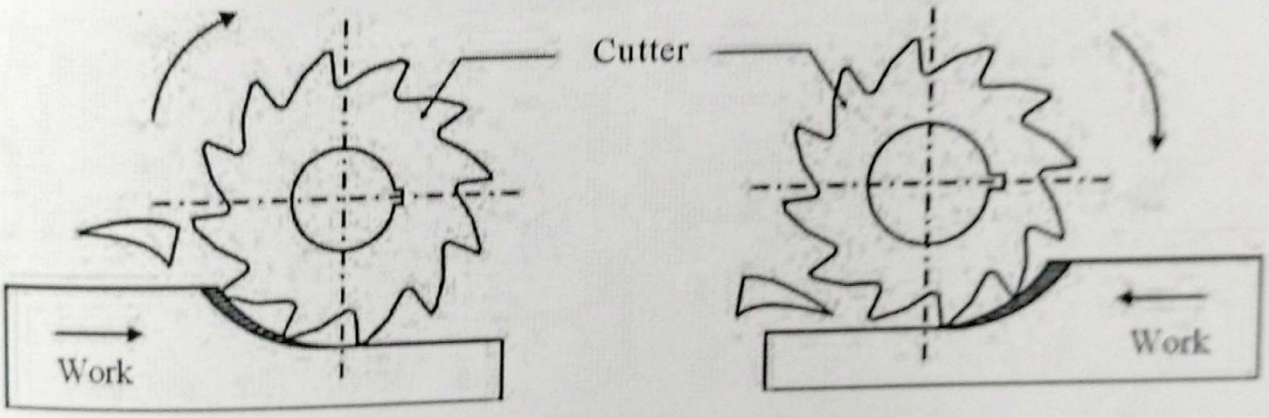
WORKSHOP PRACTICE (MECH1011)

WORK INSTRUCTION SHEET

MILLING

Milling is a metal removal process (machining) in which material is removed from work piece in the form of chips by the application of a rotary cutting tool, called milling cutter (multipoint cutting tool), having multiple nos. of cutting teeth on its periphery. With this process we can make different types of configuration on work piece. Generally, the milling cutter is given cutting motion while the work piece is given feed. Depending upon the direction of feed and cutting motion we can classify milling into two types.

1. **Up milling (Conventional milling)** in which cutting tip and the work piece moves in opposite direction to each other.
2. **Down milling (Climb milling)** in which cutting tip and the work piece moves in the same direction (seems like cutter is climbing on work piece.)



Upmilling **Downmilling**

Upmilling and Down Milling

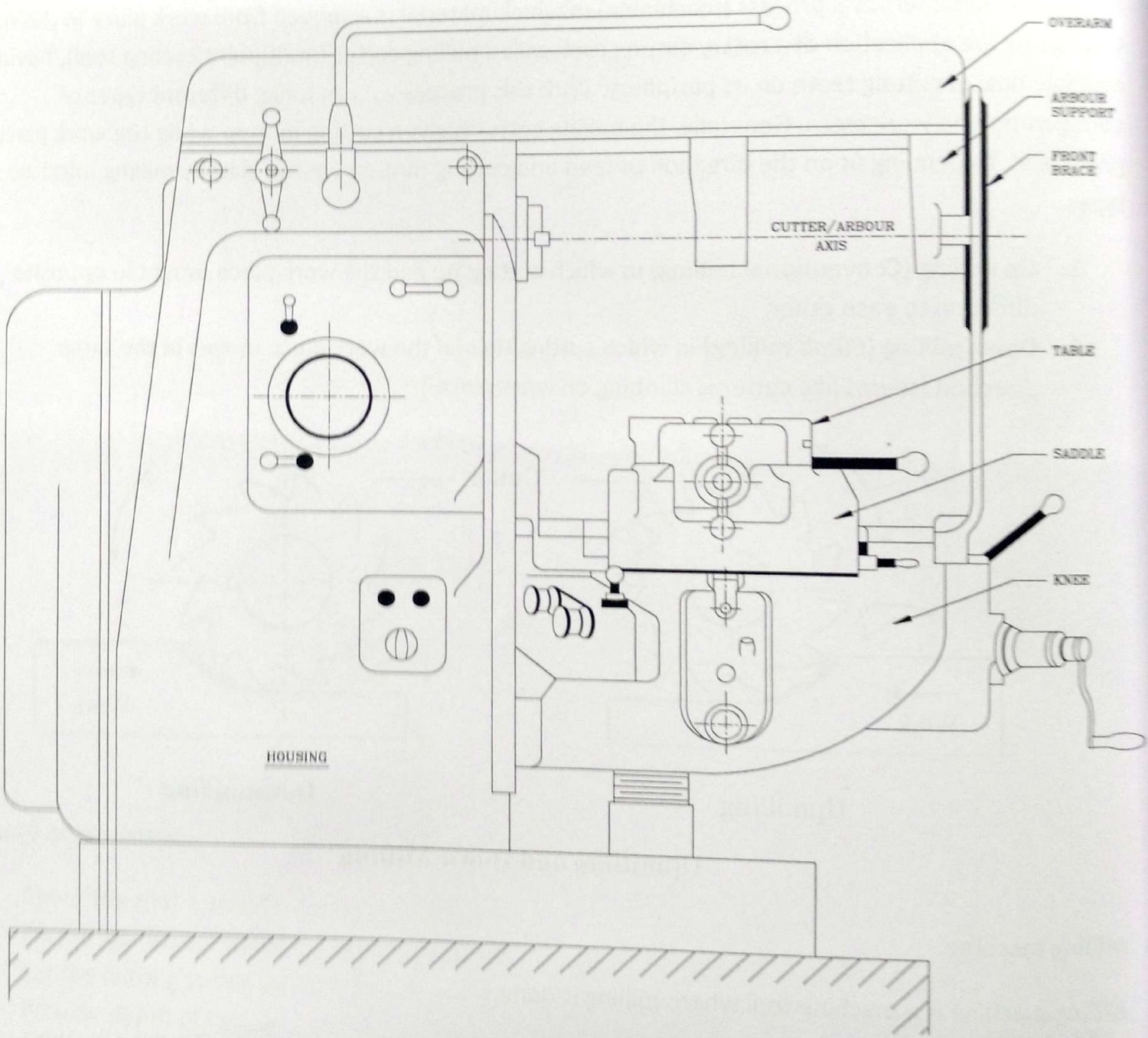
Milling machine:

Milling machine is a machine tool where milling is done.

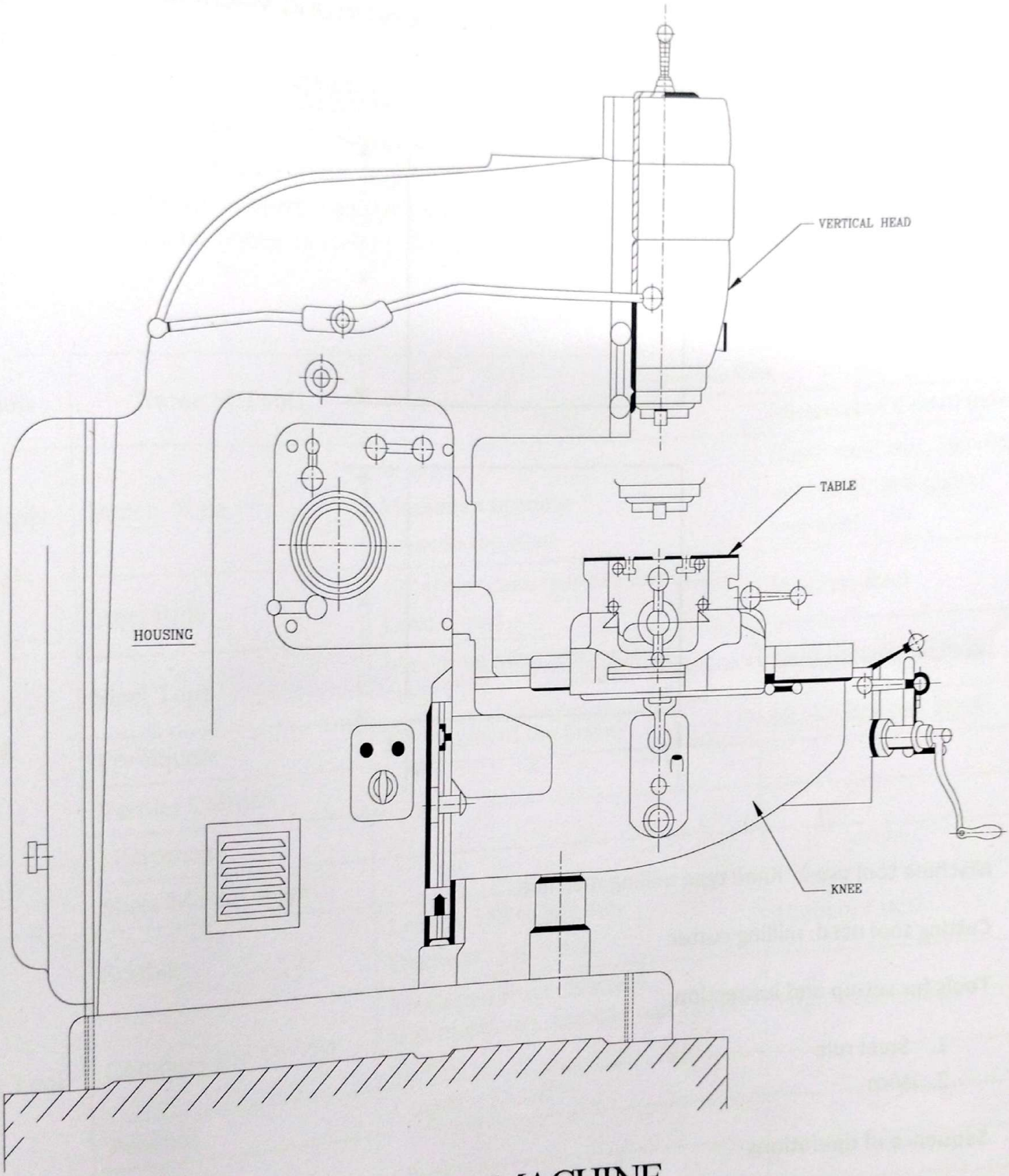
A knee type horizontal arbor milling machine is shown in figure below. The parts of milling machine are as follow:

1. **Milling arbor** to hold the milling cutter.
2. **Arbor support**
3. **Overarm**

4. **Machine table** on which the job and job holding devices are mounted to provide feed.
5. **Saddle**
6. **Power drive** with speed and feed gear box to provide power and motions to tool and work.
7. **Knee** which moves up and down.
8. **Column with base** which is main structural body.



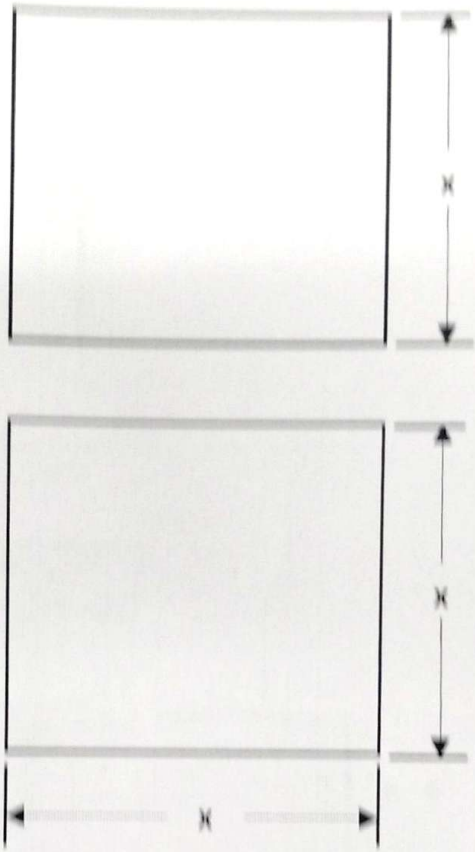
HORIZONTAL ARBOUR MILLING MACHINE



VERTICAL MILLING MACHINE

Job name: MAKING A FLAT SURFACE ON A SQUARE BLOCK IN MILLING MACHINE

Job diagram



Machine tool used: Knee type milling machine

Cutting tool used: milling cutter

Tools for set-up and inspection:

1. Steel rule
2. Vice

Sequence of operations

1. Hold the cube on a vice fixed on the table.
2. Bring the milling cutter (having some rotational speed) in contact with the surface of the job that is to be machined.
3. Provide depth of cut by lowering the cutter.
4. Give continues feed either manually or automatically.
5. Repeat the procedures for the several pass (if required) and finally get the machined surface.

HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHNICAL ENGINEERING
WORKSHOP PRACTICE (MECH1011)
WORK INSTRUCTION SHEET

SHEET METAL SHOP

roduction: Sheet metal work has its own significance in the engineering work. Many products, which fulfill the usehold needs, decoration work and various engineering articles, are produced from sheet metals. Common amples of sheet metal work are hoopers, canisters, guards, covers, pipes, hoods, funnels, bends, boxes etc. Such icles are found less expensive, lighter in weight and in some cases sheet metal products replace the use of castings forgings.

ools used:

Types of Tools	Name of Tools	Specification	
		Size	Material of Construction
A. Holding Tools	Bench Vice	Width: Maximum opening between the jaws:	Body: steel cast, Handle: mild steel, Jaw plates: cast steel
B. Measuring Tool	Steel Rule	12" (Maximum measureable length) Least Count	Stainless steel
	Steel Tape	Maximum measureable length Least Count	Cold rolled steel strip
	Try Square	6" (Length of the blade)	HCS / Stainless Steel
	Vernier Caliper		
	Micrometer		
	Sheet Metal Gauge		
C. Marking Tool	Scriber	Length: 150 to 300 mm Diameter: 3 to 5 mm.	Hardened steel
	Compass and Divider	Maximum length between legs/maximum diameter that can be drawn	High carbon steel
	Punches	Length – 3'' / 4''	
	Trammel		
D. Cutting Tool	Hand Shear or Snip		
	Shearing Machine		
E. Striking Tool	Setting Hammer		
	Wooden Mallet	Diameter: 5 cm	wood
	Riveting Hammer	0.11 kg to .91 kg	Plain steel (0.6% carbon)
	Raising Hammer		
F. Miscellaneous	Rivet Set		Tool steel
	Hand Grooves		

	Soldering Iron		Forged piece: copper Rod: Iron Handle: Wood

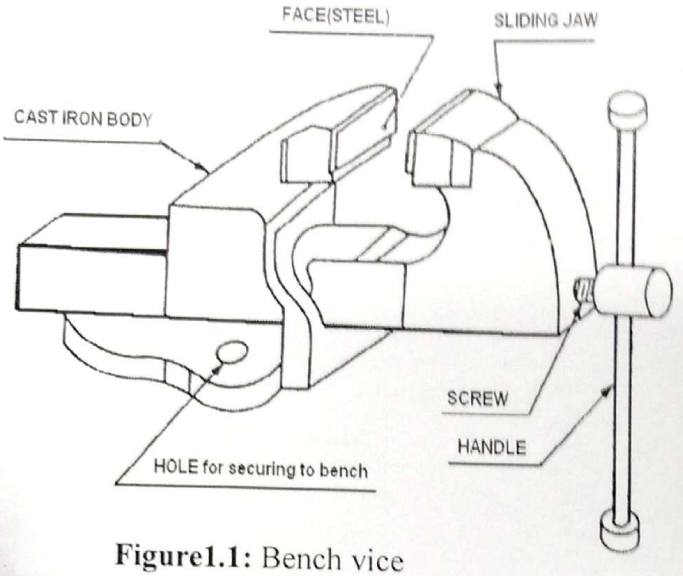
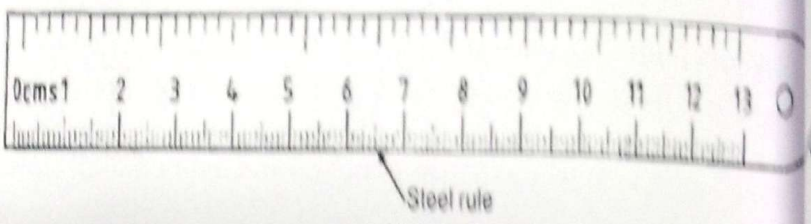


Figure1.1: Bench vice



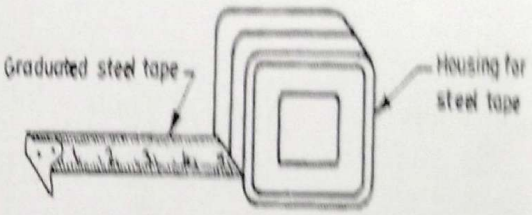


Figure2.1: Steel Rule and Steel Tape

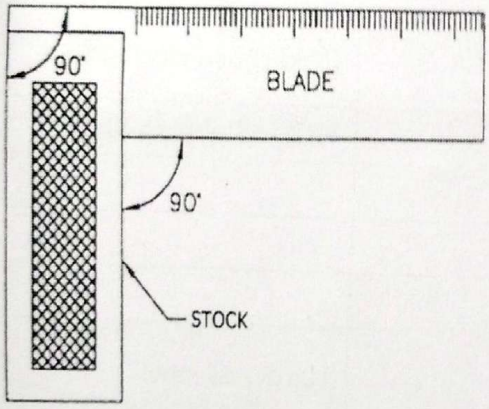


Figure2.2: Try-square

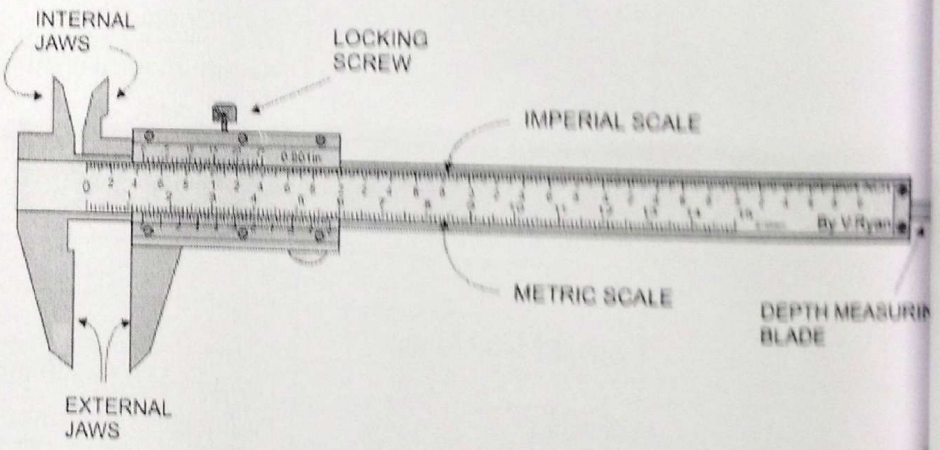


Figure 2.3: Vernier Caliper

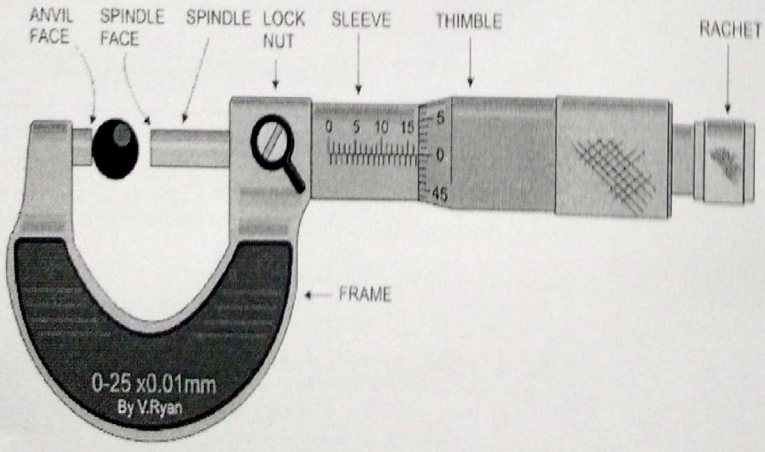


Figure 2.4: Micrometer

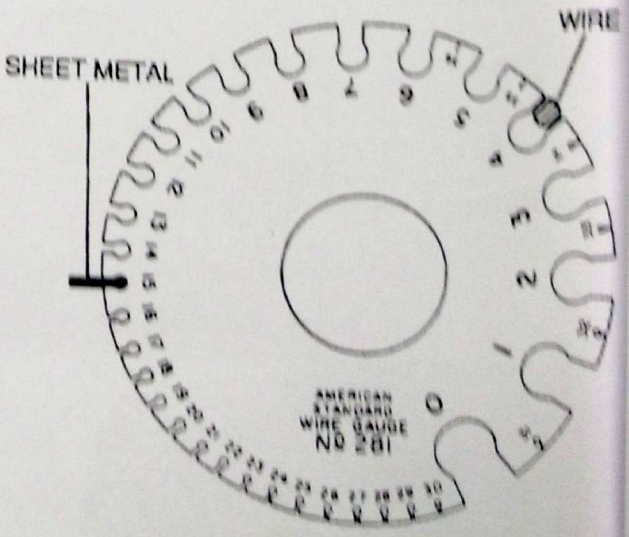


Figure 2.5: Sheet Metal Gauge / Wire Gauge

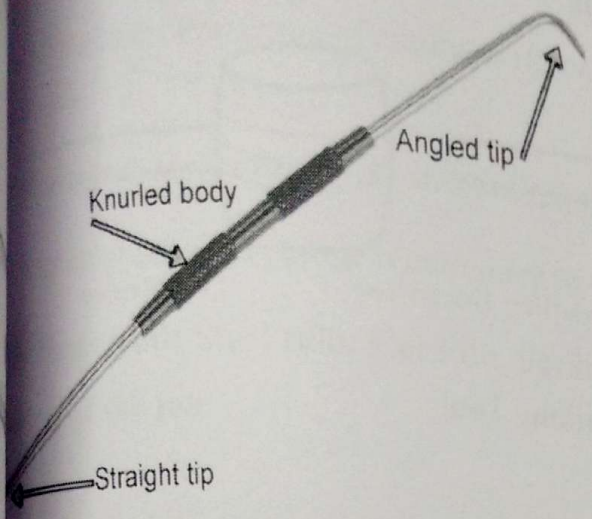


Figure 3.1: Scriber

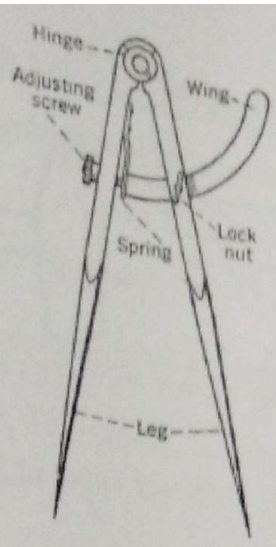


Figure 3.2: Divider

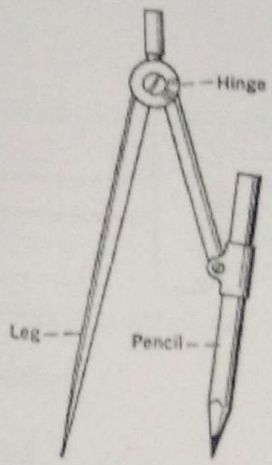


Figure 3.3: Compass

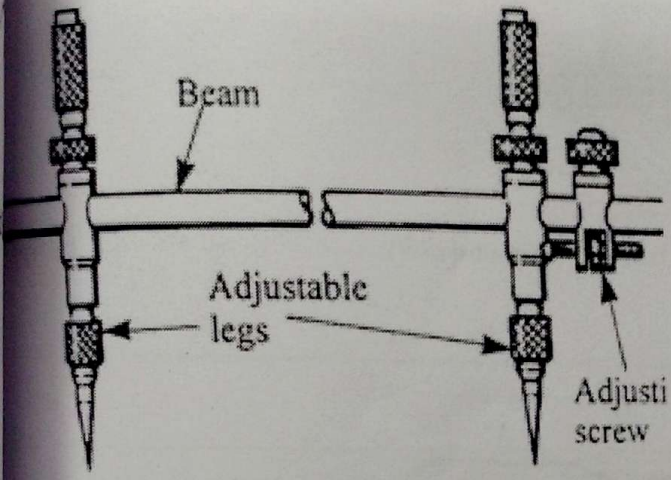


Figure 3.4: Trammel

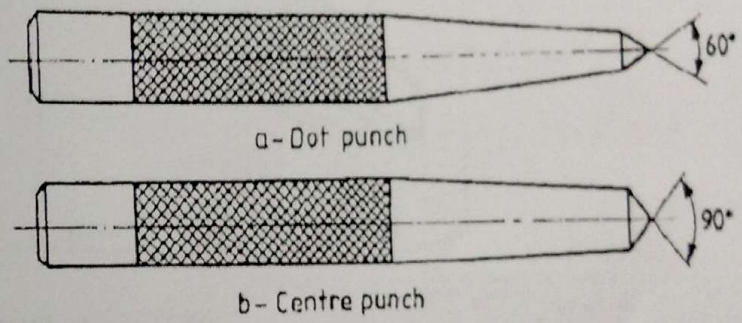


Figure 3.5: Punches

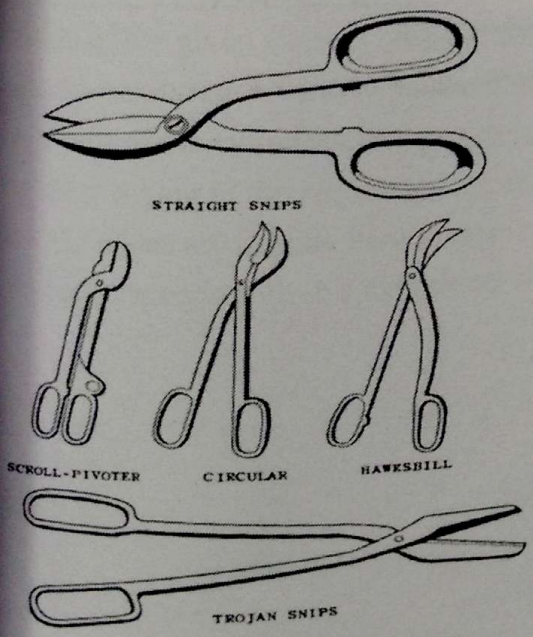


Figure 4.1: Snip or Hand Shear

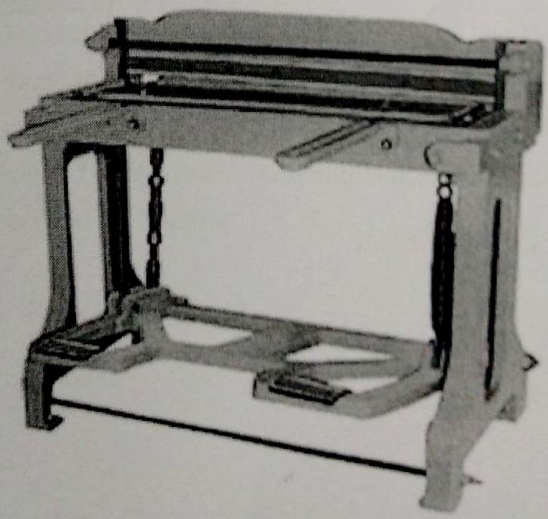


Figure 4.2: Shearing Machine

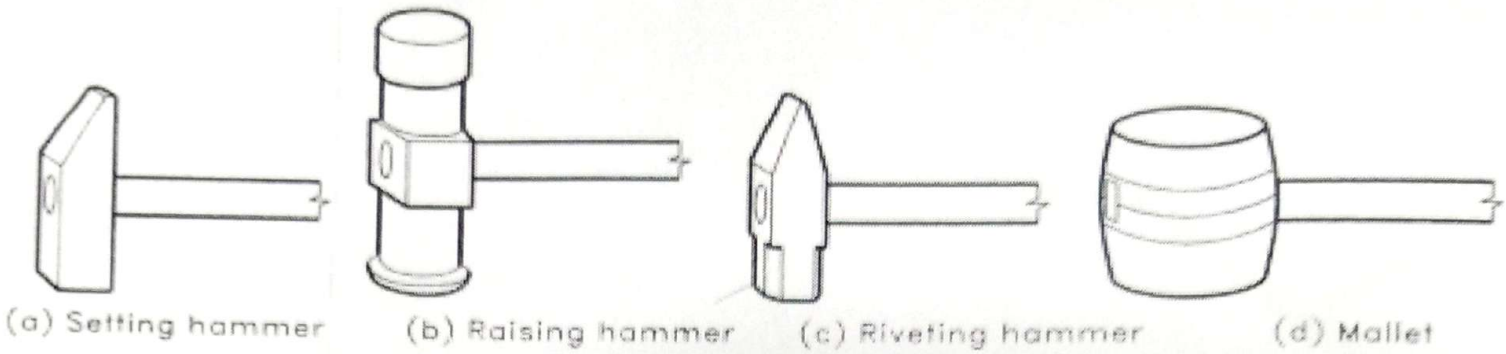
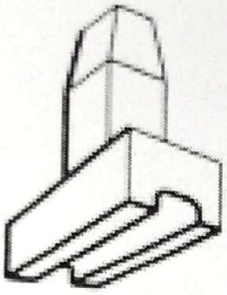


Figure 5.1: Different Types of Striking Tool



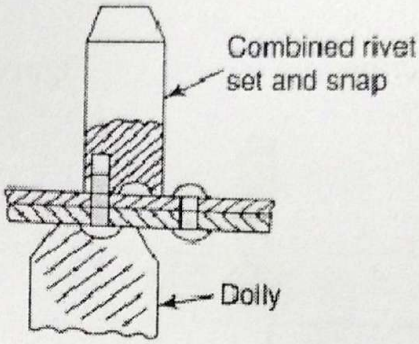


Fig. 6.14 *Rivet set and dolly*

Figure 6.1: Hand Grooves

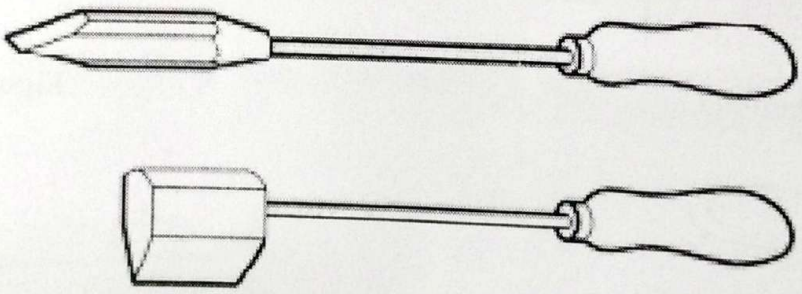


Figure 6.3: Soldering Iron

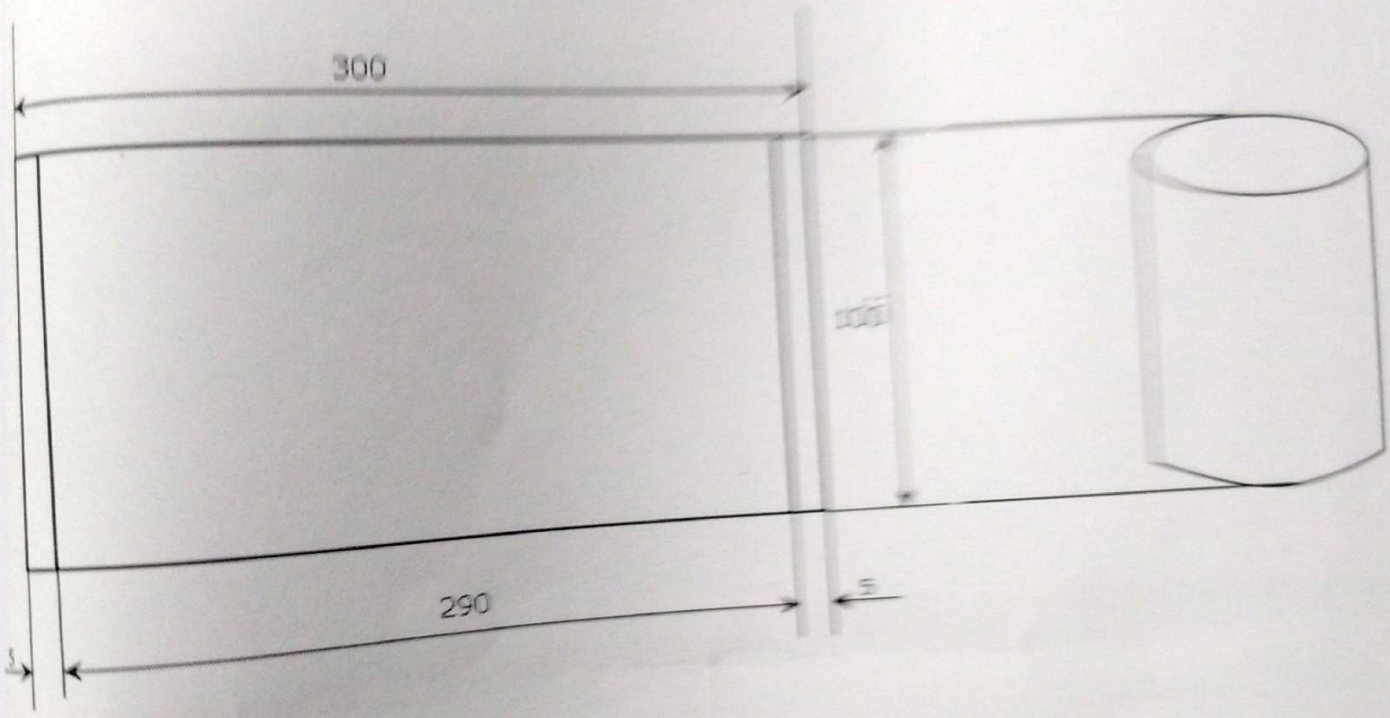
e of the Job: Practicing of cutting different geometrical shape and formation of frustum cone pipe as per required sions.

Materials: Galvanized Iron Sheet of required dimension

Material Size: As per the requirement to make a cylindrical pipe

ls Required: Steel rule, Flat File, Scriber, Try square, Shear Cut Pliers and Mallet.

wing of the job:



QUENCE OF OPERATION:

The size of the given sheet is checked with steel rule.
Mark the measurement and make the development surface sketch diagram.
The layout of the cylindrical shape pipe is marked on the given sheet.
The sheet is bent to the required shape using mallet and rolling machine.
Now the edges are slightly bent to one is one side and the other is opposite side, using stakes and mallet.
Join both the ends with in a cylindrical shape or join the two end by brazing.