

# HERITAGE INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

WORKSHOP PRACTICE (MECH1011)

WORK INSTRUCTION SHEET

## FITTING SHOP

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

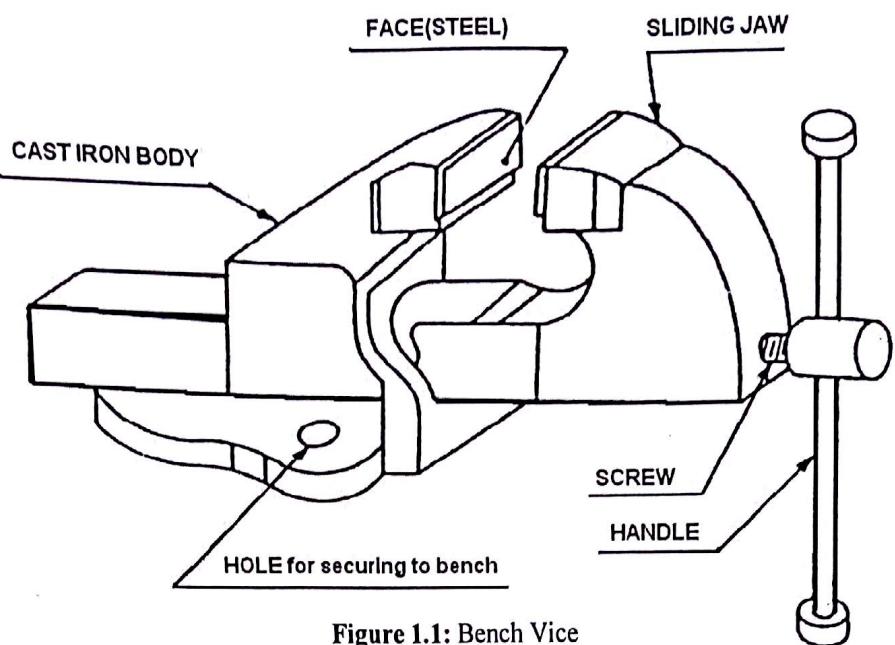
The term 'bench work' refers to the production of components by hand on the bench, whereas fitting deals with the assembly of mating parts, through removal of metal, to obtain the required fit by filling, chipping, sawing, scraping, tapping etc after the machine operations and this may or may not be carried out at the bench.

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

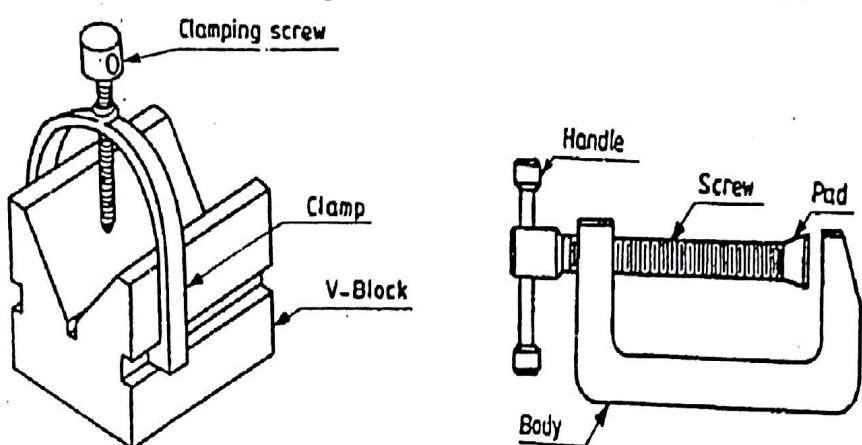
### TOOLS USED:

Types of Tools	Name of Tools	Specification	
		Size	Material of Construction
A. Holding Tools	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 held, Inclination	Stainless Steel / Carbon
B. Measuring Tool	Steel Rule	12" (Maximum measurable length), Least Count	Stainless Steel
	Steel Tape	Maximum measurable 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 Blade 90-60° Angle 60-50°	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 → Flat → Round → Triangular	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

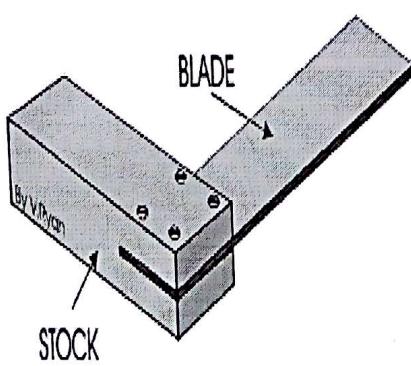


**Figure 1.1:** Bench Vice

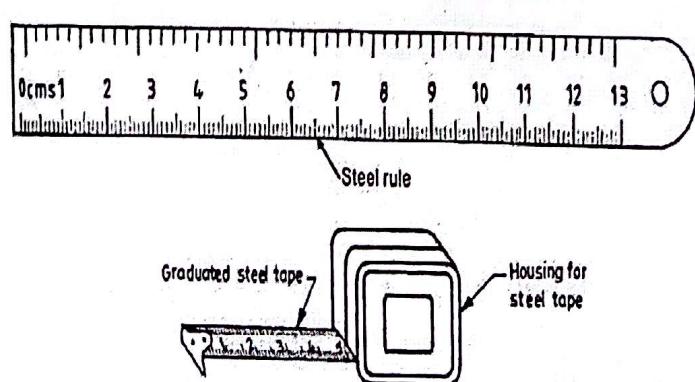


**Figure 1.2:** V-Block

**Figure 1.3:** C-Clamp



**Figure 2.1:** Try Square



**Figure 2.2:** Steel Rule and Steel Tape

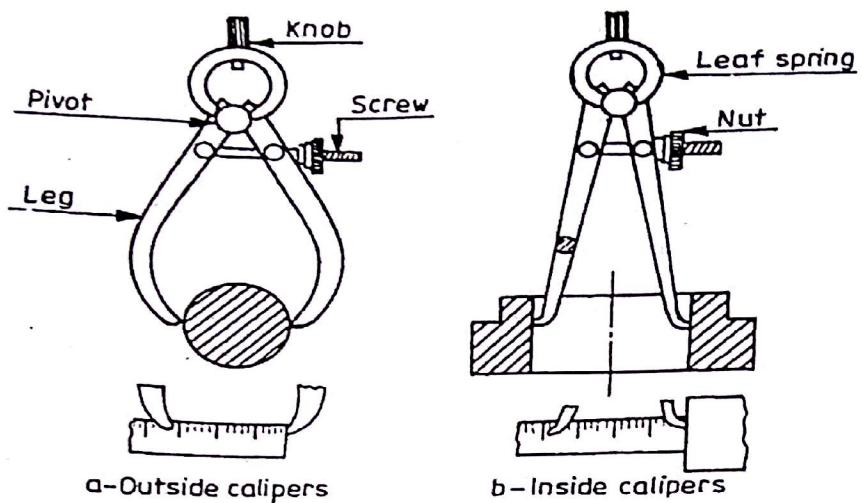


Figure 2.3: Calipers

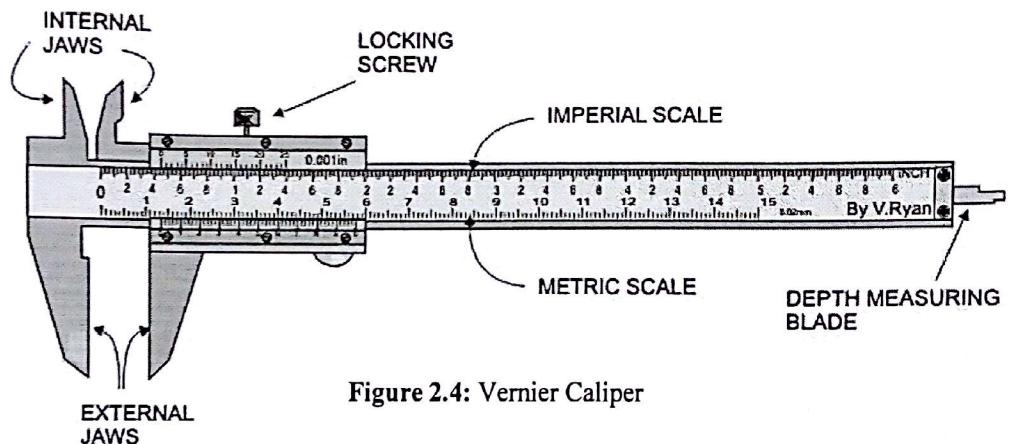


Figure 2.4: Vernier Caliper

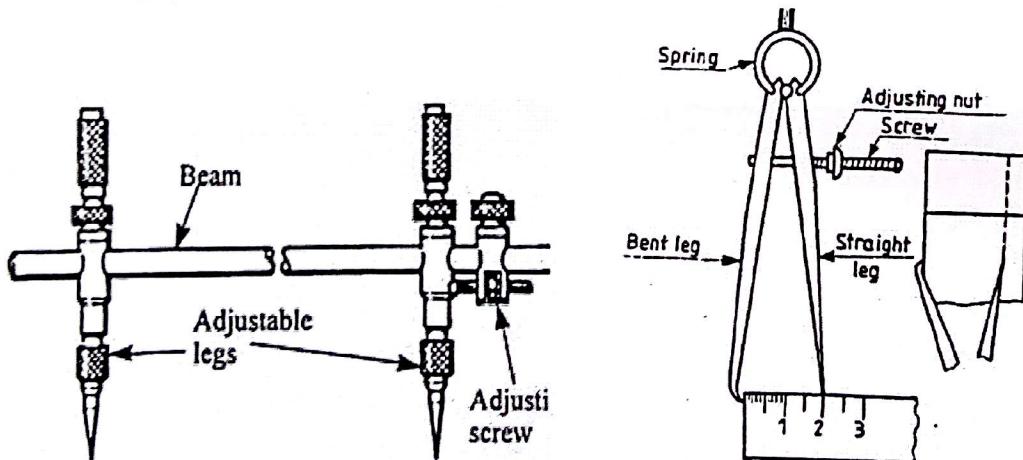
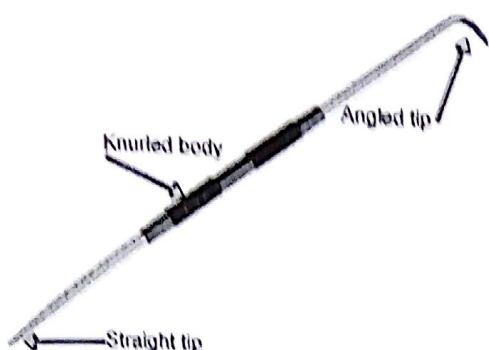
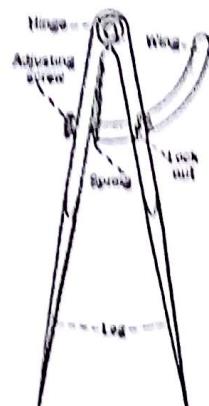


Figure 3.1: Trammel

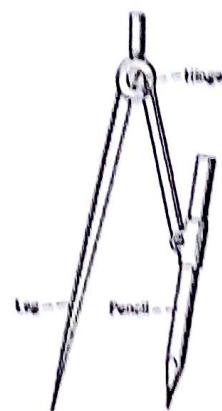
Figure 3.2: Odd-Leg Caliper



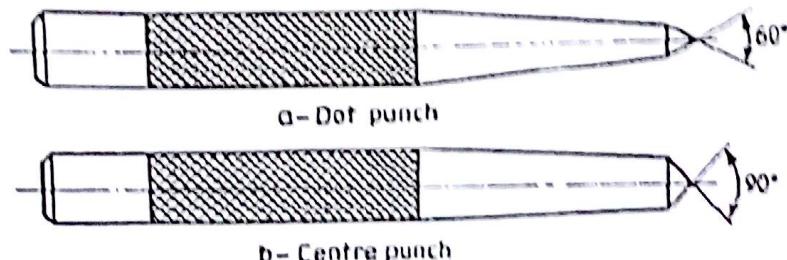
**Figure 3.3:** Scribe



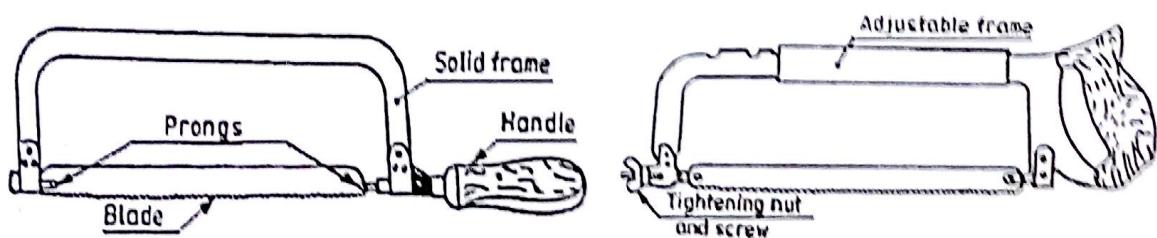
**Figure 3.4:** Divider



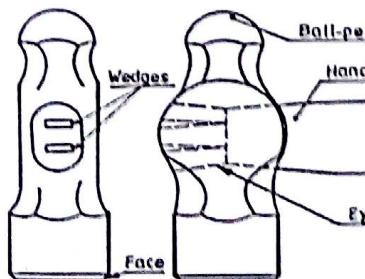
**Figure 3.5:** Compass



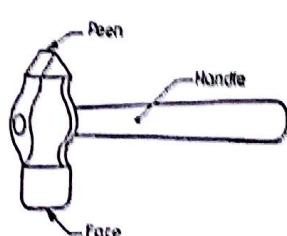
**Figure 3.6:** Punches



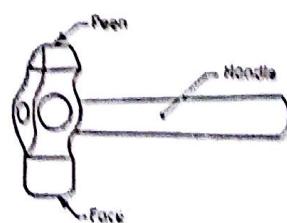
**Figure 3.7:** Hacksaw frame with blade



**Figure 6.1:** Ball Peen Hammer



**Figure 6.1:** Ball Peen Hammer



**Figure 6.1:** Ball Peen Hammer

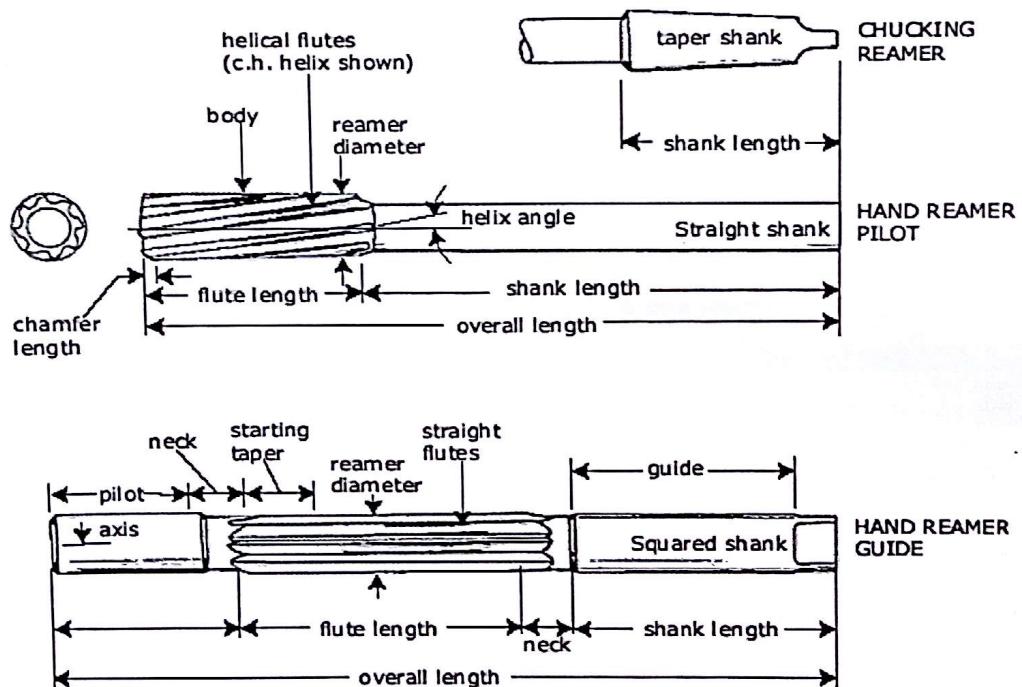
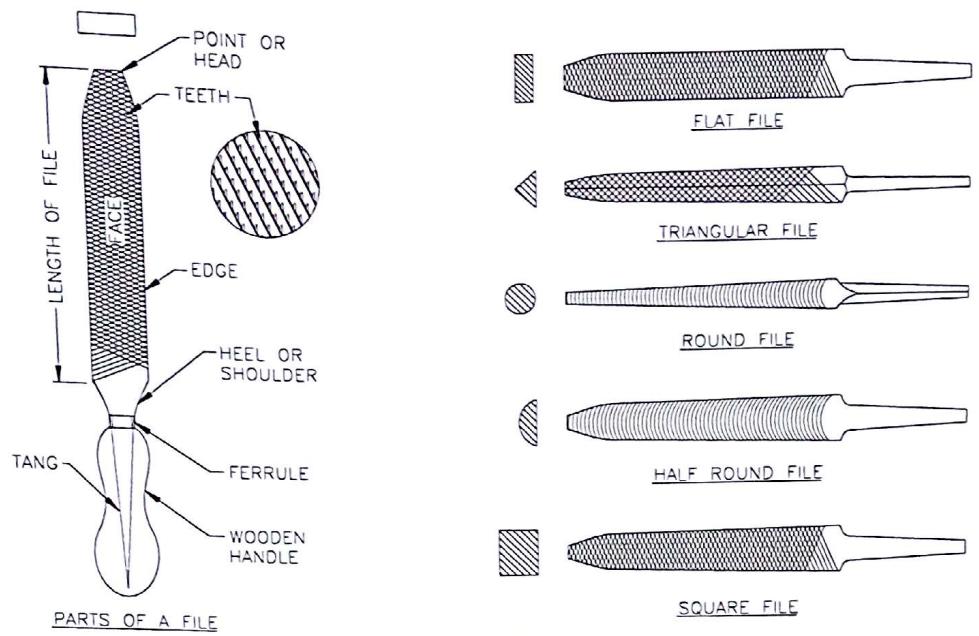


Figure 7.2: Reamer

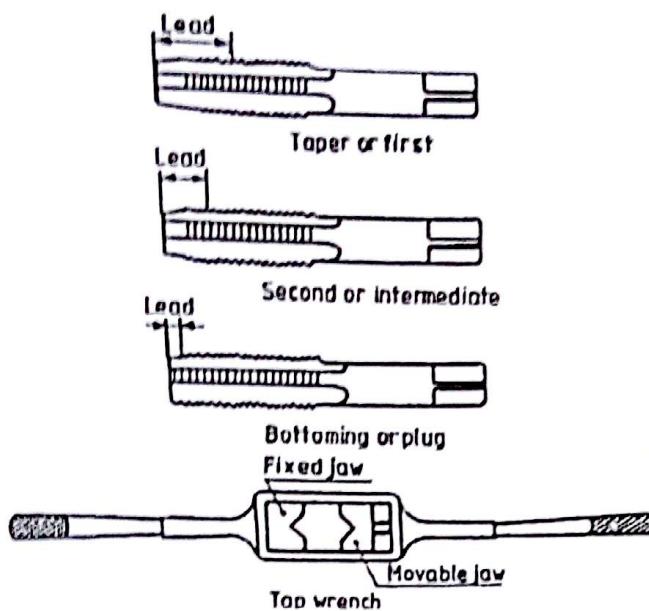


Figure 8.1: Taps and Tap Wrench

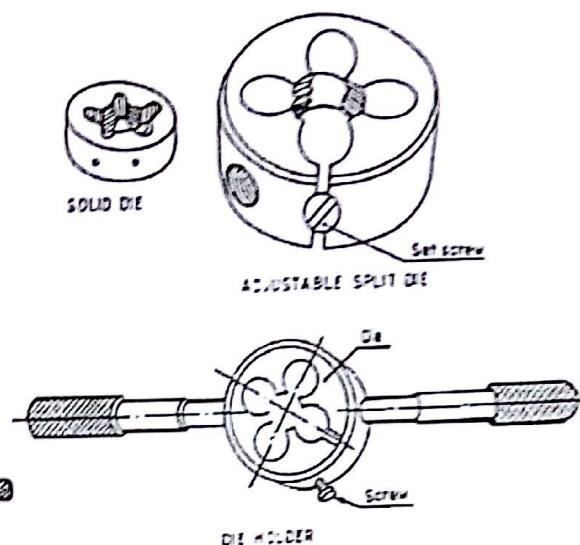


Figure 8.2: Dies and Die Holder

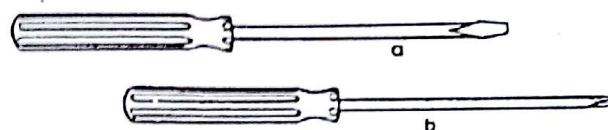


Figure 9.1: Screw Driver

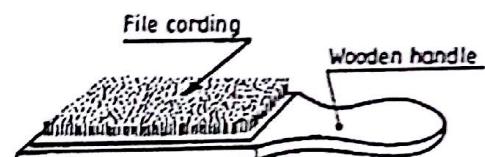


Figure 9.2: File Card

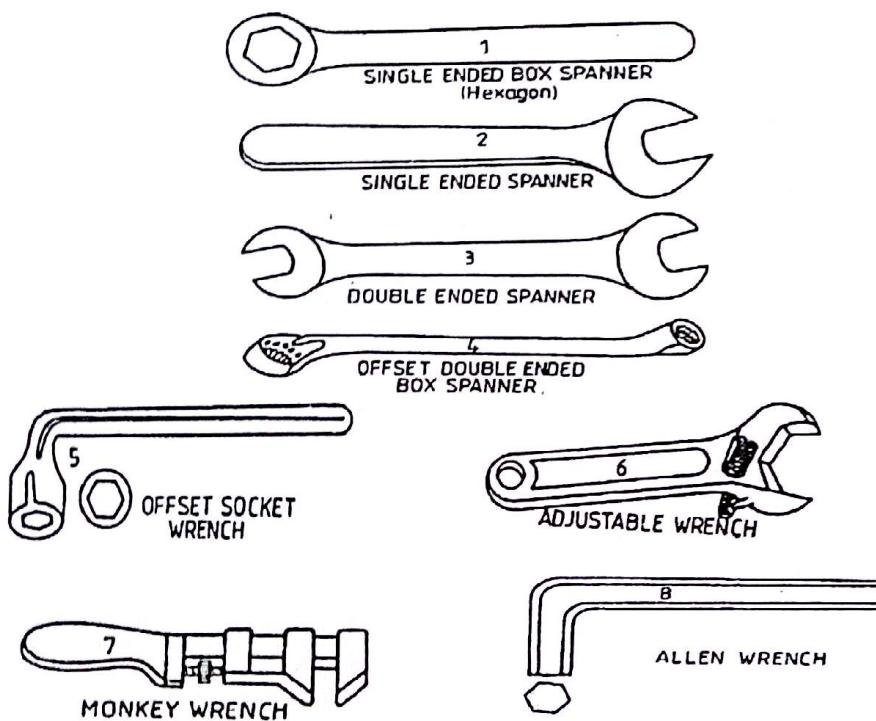


Figure 9.3: Spanners

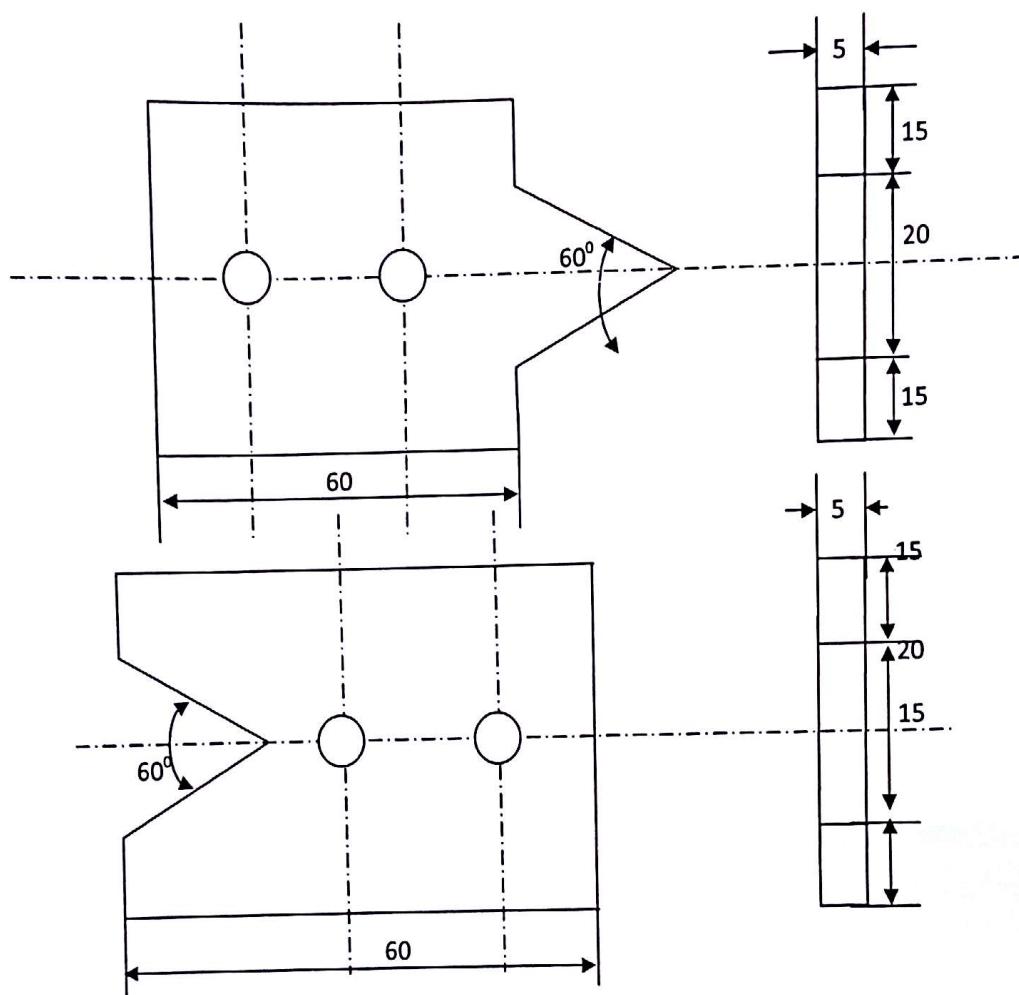
**JOB 01**  
**JOB NO. MECH1011/02**

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

**RAW MATERIALS:** Mild Steel Plate

**RAW MATERIAL SIZE:** 60mm Length x 50mm Width x 5mm Thick

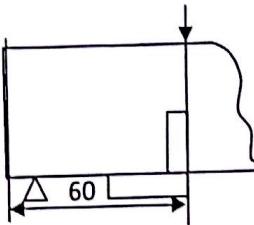
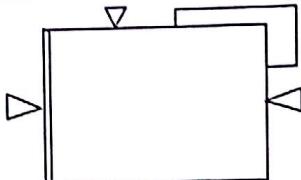
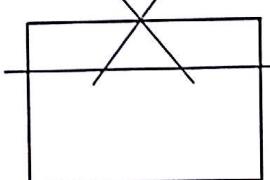
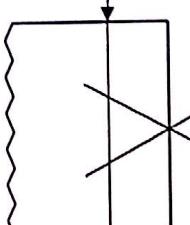
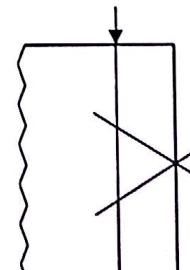
**DRAWING OF THE JOB:**

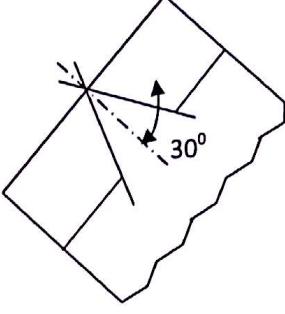
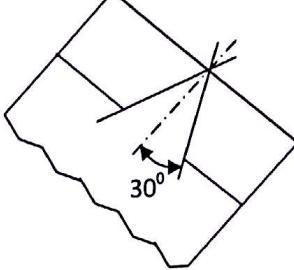
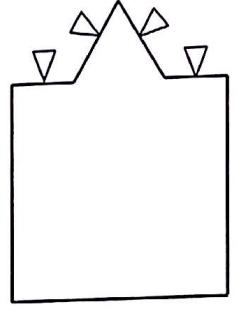
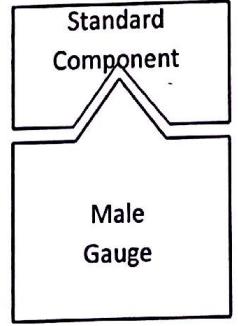


All Dimensions are in mm

## SEQUENCE OF OPERATION FOR MALE GAUGES:

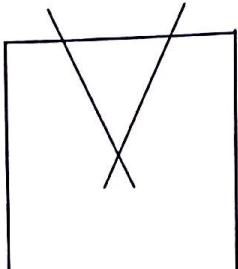
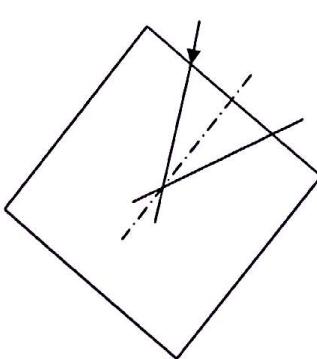
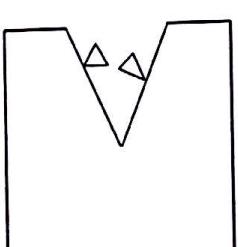
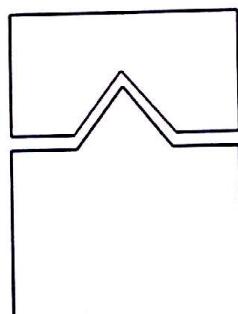
MECH1011

Sl. No.	Operation	Schematic diagram	Tools required
1.	Filling, Marking and Parting off Required Length.		Scale, Try-square, scribe, 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, Scribe, 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.	<p>Sawing the <math>30^\circ</math> inclined surface up to required length.</p>		Hack saw
8.	<p>Sawing the other side <math>30^\circ</math> inclined surface up to required length.</p>		Hack saw
9.	<p>Filling all saw-cut edges for final finishing.</p>		Flat file
10.	<p>Checking</p>		Standard component

**SEQUENCE OF OPERATION FEMALE GAUGES:**

MECH1011

Sl. No.	Operation	Schematic diagram	Tools required
1.	Marking Construction lines as required		Scale, Protractor, Scribe, Centre Punch, Hammer.
2.	Sawing the $30^\circ$ 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**

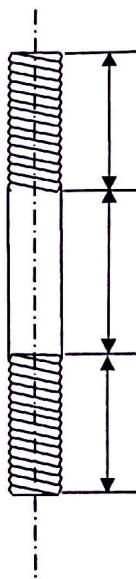
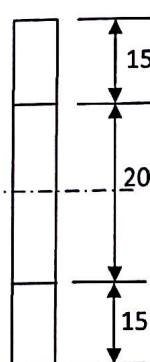
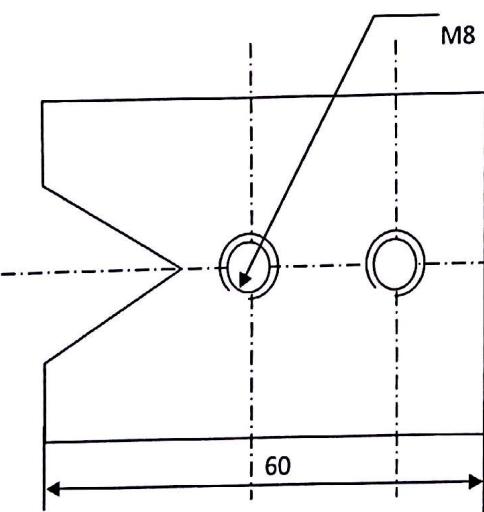
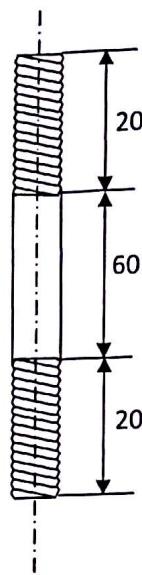
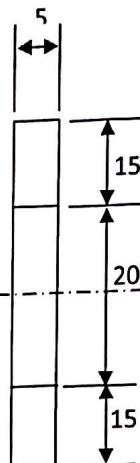
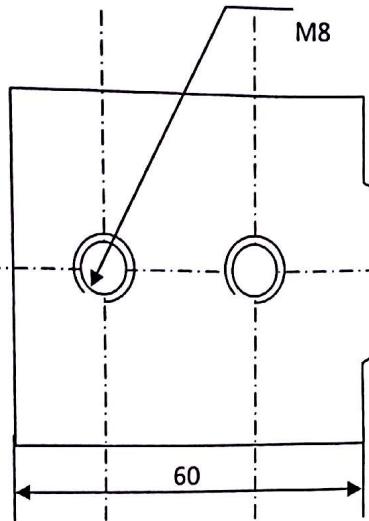
**JOB NO: MECH1011/03**

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

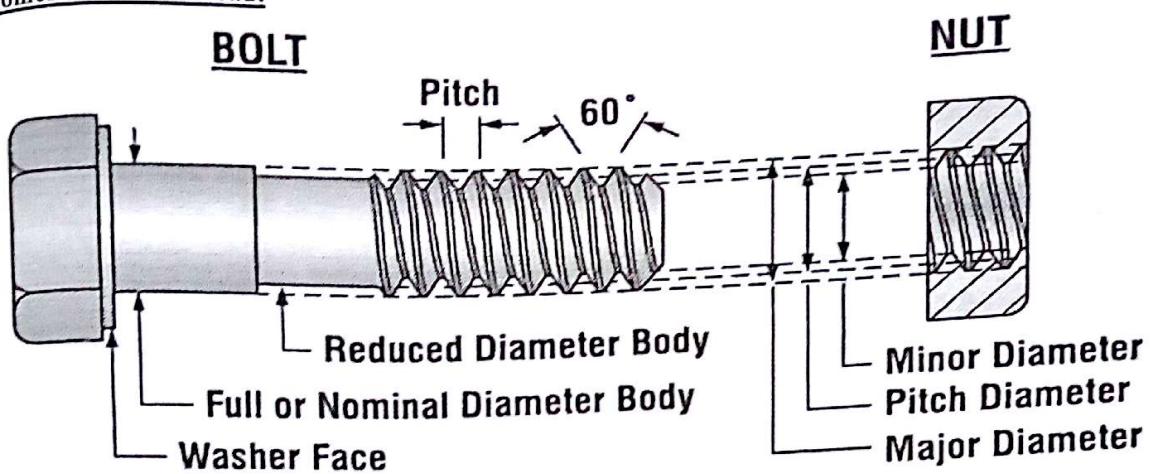
**Raw Materials:** Mild Steel Plate and MS Rod

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

**Drawing of the Job:**

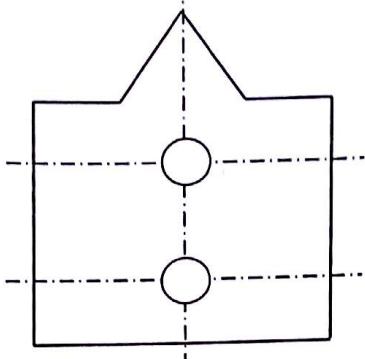
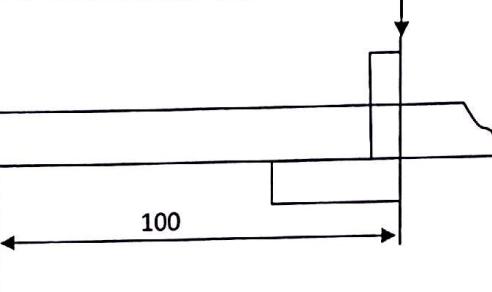
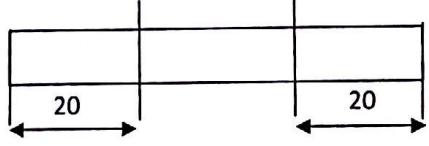
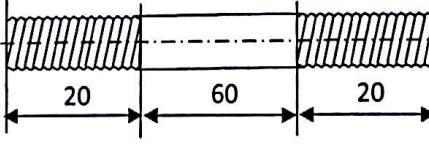
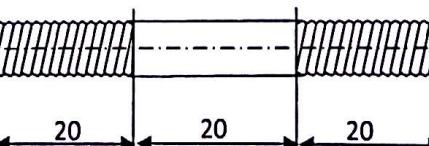


Nomenclature of thread:



**SEQUENCE OF OPERATION FOR INTERNAL THREAD ON MALE GAUGE AND EXTERNAL THREAD 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, scribe, 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.

SEQUENCE 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.