

**WORKSHOP -II MANUAL**  
**FOR**

**3<sup>RD</sup> SEMESTER**  
**MECHANICAL**



**GOVERNMENT POLYTECHNIC JAJPUR**

# WORKSHOP -II

## CONTENTS

### *Name of the Experiment*

#### **FITTING PRACTICES:-**

- Preparation of calliper
- Preparation of try square
- Preparation of hammer

#### **CARPENTRY PRACTICES:-**

- Cutting of slot, botch, mortise and Tenon
- Preparation of single dove tail joint

#### **SMITHY PRACTICES:-**

- Preparation of door ring with hook
- Preparation of hexagonal head bolt
- Preparation of octagonal flat chisel

#### **WELDING PRACTICES**

1. LAP AND BUTT JOINT USING ARC WELDING
2. LAP JOINT USING GAS WELDING.
3. JOINING TWO NON FERROUS PARTS THROUGH TIG/MIG WELDING.

## **EXPERIMENT NO- 01**

### **AIM OF THE EXPERIEMENT:-**

To prepare a calliper.

### **APPARATUS REQUIRED :-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	Hacksaw frame with blade	300mm	01
02	Bastard File	300mm	01
03	Smooth File	250mm	01
04	Hammer	0.25Kg	01
05	Punch	150mm	01
06	Steel Rule	300mm	01
07	Drill Bit	Ø6mm	01
08	Marking Media		As per requirement
09	Drilling Machine	Bench Type	01

### **RAW MATERIAL REQUIRED:-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	M.S. Flat	2 (160X20X6)mm	02
02	M.S. Rivet	Ø6mmX10mm	01

### **PROCEDURE:-**

- File the two adjacent edges of the M.S Flat to right angle.
- Apply the marking media to mark the job as per sketch and punch the marking line.
- Remove the extra material by sawing and chipping and then file the job to the required shape.
- Drill the holes on the two pieces and clean the burrs.
- Assemble the two parts by riveting.
- Finish all sides, edges and surfaces properly.

### **CONCLUSION:-**

Hence the outside calliper is made and required dimension has prepared.

## **EXPERIMENT NO 02**

### **AIM OF THE EXPERIEMENT :-**

To prepare a Try Square.

### **APPARATUS REQUIRED :-**

<b>SL. NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	Hacksaw frame with blade	300mm	01
02	Bastard File	300mm	01
03	Smooth File	250mm	01
04	Hammer	0.25Kg	01
05	Punch	150mm	01
06	Steel Rule	300mm	01
07	Drill Bit	Ø6mm	01
08	Bench Vice	125mm	01
09	Vernier Height Gauge	300mm	01
10	Try Square	150mm	01
11	Drilling Machine	Bench Type	01
12	Marking Media		As per requirement

### **RAW MATERIAL REQUIRED:-**

<b>SL. NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	M.S. Flat	(80x30)mm Beam	01
02	M.S. Flat	(130X30)mm (Blade)	01
03	M.S. Rivet-	Ø6mmX10mm	01

### **PROCEDURE:-**

- File the two adjacent edges of the M.S Flat to right angle.
- Apply the marking media to mark the job as per sketch and punch the marking line.
- Remove the extra material by sawing and chipping and then file the job to the required shape.
- Make small hole on each flat by drilling machine.
- File the holes on the two pieces and clean the burrs.
- Assemble the two parts by riveting.
- Finish all sides, edges and surfaces properly.

### **CONCLUSION:-**

Finally a Try Square of required dimension has been prepared.

## **EXPERIMENT NO- 03**

### **AIM OF THE EXPERIEMENT :-**

To prepare a Hammer.

### **APPARATUS REQUIRED :-**

<b>SL. NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	Hacksaw frame with blade	300mm	01
02	Bastard File	300mm	01
03	Smooth File	250mm	01
04	Hammer	0.25Kg	01
05	Scriber	150mm	01
06	Lathe Machine	Centre Lathe	01
07	Vernier Calliper	200mm	01
08	Bench Vice	125mm	01
09	Lathe Cutting Tool	HSS 4"	02
10	Chuck Key	-	01
11	Drilling Machine	Bench Type	01

### **RAW MATERIAL REQUIRED:-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	M.S. Rod	(Ø40X60)mm	01
02	M.S.Rod	((Ø10X200)mm	01

### **PROCEDURE:-**

- At first fit the job in chuck of the lathe with the help of chuck key.
- Then fit the cutting tool on the tool post.
- Then test whether the job is properly fixed or not on the lathe machine.
- After that start all operations to prepare a hammer.
- At last complete all the operation and produce a hammer

### **CONCLUSION:-**

Hence a hammer is prepared as per the given dimension.

## EXPERIEMNT NO: 04

### AIM OF THE EXPERIEMNET:-

Cutting of slot, notch, mortise and tenon.

### TOOLS AND EQUIPMENT REQUIRED:-

SL. NO	NAME OF THE ITEMS	SPECIFICATION	QUANTITY
01	Carpenter's Vice	600mm	01
02	Steel Rule	300mm	01
03	Jack Plane	250mm	01
04	Try Square	150mm	01
05	Marking Gauge	150mm	01
06	Firmer Chisel	25mm	01
07	Mortise Chisel	6mm	01
08	Cross Cut Saw	300mm	01
09	Tenon Saw	250mm	01
10	Scriber	150mm	01
11	Mallet	0.25Kg	01

### RAW MATERIAL REQUIRED:-

SL NO	NAME OF THE ITEMS	SPECIFICATION	QUANTITY
01	Wood Size	(50X50X250) mm	01

### PROCEDURE:

- The given raw material is checked to ensure its correct size.
- The material is firmly clamped in the carpenter's vice and one of its faces are planed by the jack plane and checked for straightness.
- The adjacent face is then planed and the faces are checked for squareness with the try square.
- Marking gauge is set and lines are drawn at 30 and 45mm to mark the thickness and width of the model respectively.
- The excess material is first chiselled out with the firmer chisel and then planed to correct size.
- The matching dimension of the part X and Y are then marked using the scale and marking gauge.
- Using the cross cut saw the portions to be removed in part Y (Tenon) is cut followed by chiselling.

- The material to be removed in Part X (Mortise) is carried out by using the mortise and firmer chisel.
- The part X and Y are separated by cross cutting with the tenon saw.
- The ends of both the part are chiselled to exact length.
- Finish chiselling is done where ever needed so that the parts can be fitted to obtain a near tight joint.

**CONCLUSION:** -The mortise and tenon joint is thus made by following the above sequence of operations.

## EXPERIEMNT: 05

### AIM OF THE EXPERIEMNET:-

To prepare a single Dove Tail joints

### TOOLS AND EQUIPMENT REQUIRED:-

SL. NO	NAME OF THE ITEMS	SPECIFICATION	QUANTITY
01	Carpenter's Vice	600mm	01
02	Steel Rule	300mm	01
03	Jack Plane	250mm	01
04	Try Square	150mm	01
05	Marking Gauge	150mm	01
06	Firmer Chisel	25mm	01
07	Mortise Chisel	6mm	01
08	Cross Cut Saw	300mm	01
09	Tenon Saw	250mm	01
10	Scriber	150mm	01
11	Mallet	0.25Kg	01

### RAW MATERIAL REQUIRED:-

SL NO	NAME OF THE ITEMS	SPECIFICATION	QUANTITY
01	Wood Size	(50X50X250)mm	01

### PROCEDURE:

- The give raw material is checked to ensure its correct size.
- The material is firmly clamped in the carpenter's vice and any two adjacent faces are planned by the jack plane and checked for straightness.
- The adjacent face is then planed and the faces are checked for squareness with the try square.
- Marking gauge is set and lines are drawn at 30 and 45mm to mark the thickness and width of the model respectively.
- The excess material is first chiselled out with the firmer chisel and then planned to correct size.
- The matching dimension of the part X and Y are then marked using the scale and marking gauge.
- Using the cross cut saw the portions to be removed in part Y (Tenon) is cut followed by chiselling.
- The part X and Y are separated by cross cutting with the tenon saw.
- The ends of both the part are chiselled to exact length.



- A fine finishing is given to the parts if required so that proper fitting is obtained.
- The parts are fitted to obtain a slightly tight joint.

**CONCLUSION:** -The single Dove Tail joint is thus made by following the above sequence of operations.

## **EXPERIMENT NO- 06**

### **AIM OF THE EXPERIEMENT:-**

To Prepare a Door ring with Hook.

### **APPARATUS REQUIRED:-**

<b>SL. NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	Round Nose Tong	300mm	01
02	Hammer	2Kg and 1.25Kg	02
03	Anvil	50Kg	01
04	Swage Bock	80Kg	01
05	Forge or Hearth	-	01

### **RAW MATERIAL REQUIRED:-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	M.S. Rod	Ø10X100mm	01
02	M.S. Rod	Ø6X100 mm	01

### **PROCEDURE:-**

- At first maintain the required size of the M.S. Rod.
- Now put the two M.S. Rods in the previously burning hearth.
- The M.S. Rod takes heat from the hearth and its temperature begins to increase.
- When its temperature reaches 1000<sup>0</sup>C to 1200<sup>0</sup>C approx., it comes to red hot stage.
- Now remove the M.S. Rod from the hearth and hammering it on the anvil to the required shape.
- Then fitted the hook with the ring.

### **CONCLUSION:-**

Finally a door ring with hook as shown in figure is prepared.

## **EXPERIMENT NO- 07**

### **AIM OF THE EXPERIEMENT:-**

Preparation of hexagonal head bolt

### **APPARATUS REQUIRED:-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	Round Nose Tong	300mm	01
02	Hammer	2Kg and 1.25Kg	02
03	Anvil	50Kg	01
04	Swage Bock	80Kg	01
05	Forge or Hearth	--	01
06	Char coal	--	As per requirement

### **RAW MATERIAL REQUIRED:-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	M.S. Rod	(Ø16X150)mm	01

### **PROCEDURE:-**

- At first cut the M.S. Rod to the required size.
- Now the rod put on the burning hearth to make it red hot stage.
- The M.S. Rod takes heat from the hearth and its temperature begins to increase.
- When its temperature reaches 1000<sup>0</sup>C to 1200<sup>0</sup>C, it comes to red hot stage.
- Now remove the M.S. Rod from the hearth and hammering it on the swage block/ anvil to the required shape.
- Repeat the above process till we get exact Octagonal shape.
- Then quenching the job in the water

### **CONCLUSION:-**

Finally we got a hexagonal head bolt by following the above procedure.

## **EXPERIMENT NO- 08**

### **AIM OF THE EXPERIEMENT:-**

To Prepare Octagonal Flat Chisel.

### **APPARATUS REQUIRED:-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	Round Nose Tong	300mm	01
02	Hammer	2Kg and 1.25Kg	02
03	Anvil	50Kg	01
04	Swage Bock	80Kg	01
05	Forge or Hearth	--	01
06	Char coal	--	As per requirement

### **RAW MATERIAL REQUIRED:-**

<b>SL NO</b>	<b>NAME OF THE ITEMS</b>	<b>SPECIFICATION</b>	<b>QUANTITY</b>
01	M.S. Rod	(Ø16X150)mm	01

### **PROCEDURE:-**

- At first cut the M.S. Rod to the required size.
- Now the rod put on the burning hearth to make it red hot stage.
- The M.S. Rod takes heat from the hearth and its temperature begins to increase.
- When its temperature reaches 1000<sup>0</sup>C to 1200<sup>0</sup>C, it comes to red hot stage.
- Now remove the M.S. Rod from the hearth and hammering it on the swage block to the required shape i.e. octagonal shape.
- Repeat the above process till we get exact Octagonal shape.
- Then quenching the job in the water.

### **CONCLUSION:-**

Finally we got an Octagonal Flat Chisel by following the above procedure

## **EXPERIMENT NO : 09**

### **AIM OF THE EXPERIEMENT:**

To prepare a Butt Joint through Arc welding.

### **APPARATUS REQUIRED:**

SL NO.	NAME OF THE APPARATUS	SPECIFICATION	QUANTITY
01	Rough File	300mm	01
02	Arc welding Machine	350 amperes	01
03	Electrode Holder	300 amp/800 amp	01
04	Ground Clamp	100 mm	01
05	Tongs	300 mm	01
06	Welding Hand Screen	(108 x 82) mm	01
07	Hammer	Chipping Type	01
08	Apron	Lather	01
09	Gloves	lather	01 pair

### **RAW MATERIAL REQUIRED:**

Two number of M.S Flat with dimension (80x40x6)mm.

### **PROCEDURE:**

- The given M.S Flats are thoroughly cleaned .
- The two pieces of M.S Flat positioned on the welding table (as shown in figure) such that they are separated slightly for better weld joints and well penetration of the weld.
- Then electrode is fitted in the electrode holder and the welding current is to be set with proper value according to the requirement.
- Before welding operation some precaution has to be taken. These are wearing apron, using hand gloves and hand screen.
- The welding process is done with proper selection of welding parameters (accelerating voltage, welding current, welding speed) on the welding machine.
- Then welding is done by the help of electrode holder with filler metals, then arc is created by the contact with electrode and work piece.

- During the process of welding the electrode is kept at 15 to 25 degree angle from vertical and the direction of welding respectively.
- After welding operation is completed the scale formation on the welding zone is removed by the help of chipping hammer.

**CONCLUSION:**

The Butt Joint is thus made using above procedure.

## **EXPERIMENT NO : 10**

### **AIM OF THE EXPERIEMENT:**

To prepare a Lap Joint through Gas welding

### **APPARATUS REQUIRED:**

SL NO.	NAME OF THE APPARATUS	SPECIFICATION	QUANTITY
01	Oxygen cylinder	7 m <sup>3</sup> /120-150 Kg/cm <sup>2</sup>	01
02	Acetylene Cylinder	6 m <sup>3</sup> /15-16 Kg/cm <sup>2</sup>	01
03	Hand Screen	(108 x 82) mm	01
04	Hammer(Chipping)	200 gm	01
05	Tongs	300 mm	02

### **RAW MATERIAL REQUIRED:**

Two number of M.S Flat with dimension (75x40x6)mm.

### **PROCEDURE:**

- ✘ The given M.S Flats are thoroughly cleaned.
- ✘ Before welding operation some precaution has to be taken. These are wearing apron using hand gloves, hand screen and Goggles.
- ✘ Oxygen and acetylene are supplied through the different cylinder. Oxygen cylinder is painted in Black colour and acetylene cylinder is Marked in Maroon colour
- ✘ The workpieces are positioned(as shown in figure) on the welding table to form a lap joint with the required overlapping.
- ✘ Then welding flame is required to fuse the metal by combination of acetylene and oxygen with proper value. Acetylene and oxygen are mixed together.
- ✘ The alignment of the lap joint is checked and the tack-welded pieces are reset if required.

## **CONCLUSION:**

The Lap Joint is thus made using above procedure.



## **EXPERIMENT NO : 11**

### **AIM OF THE EXPERIEMENT:**

Joining two non-ferrous parts through TIG /MIG.

### **APPARATUS REQUIRED:**

SL NO.	NAME OF THE APPARATUS	SPECIFICATION	QUANTITY
01	MIG welding Transformer	50-80 amp	01
02	CO <sub>2</sub> cylinder	7 m <sup>3</sup>	01
03	Hand screen	(180 x 80) mm	01
04	Hammer(Chipping)	Chipping type	01
05	Tongs	300 mm	02

### **RAW MATERIAL REQUIRED:**

Two number of Aluminium Plates with dimension (75x40x6)mm.

### **PROCEDURE:**

- ☞ The given Aluminium Plates are thoroughly cleaned.
- ☞ Before welding operation some precautions has to be taken. These are Wearing apron, using hand gloves, hand screen and Goggles.
- ☞ The work pieces are positioned (as shown in figure) on the welding table to form a proper joining.
- ☞ The alignment of the weld joint is properly checked.
- ☞ The welding operations are performed by using D.C with reverse polarity (Electrode +ve and Work piece -ve).
- ☞ A control unit is required which objective is to supply the power, wire drive, movement of the Gun and regulates the gas supply.
- ☞ This welding process uses consumable electrode which is fitted through the electrode holder into the arc and the same speed of the electrode is maintained in the welding process.
- ☞ A small adjustable speed motor is used to remove wire from a spool and feed it into the arc.
- ☞ In some cases various shielding gases (CO<sub>2</sub>, He, Ar) for welding various types of carbon sheet.
- ☞ In this case the metal transfer occurs by heating both the consumable filler electrode and the work piece so that proper joining of aluminium plate takes place.

## **CONCLUSION:**

By using TIG or MIG, we can join two non-ferrous parts.