MANUFACTURING SCIENCE-II

LAB MANUAL

(EME-553)

V SEMESTER

EXPERIMENT NO.1

OBJECTIVE: Gear cutting on milling machine (Spur Gear).

APPARATUS: Steel rule, Milling cutter, Spanner, Mandrel, Dog carrier

THEORY: Milling is the machining process of using rotary cutters to remove material from a work piece advancing (or feeding) in a direction at an angle with the axis of the tool. It covers a wide variety of different operations and machines, on scales from small individual parts to large, heavy-duty gang milling operations. It is one of the most commonly used processes in industry and machine shops today for machining parts to precise sizes and shapes.

Main Components of milling machine:

Base, column, knee, saddle, table

Type of milling machine:

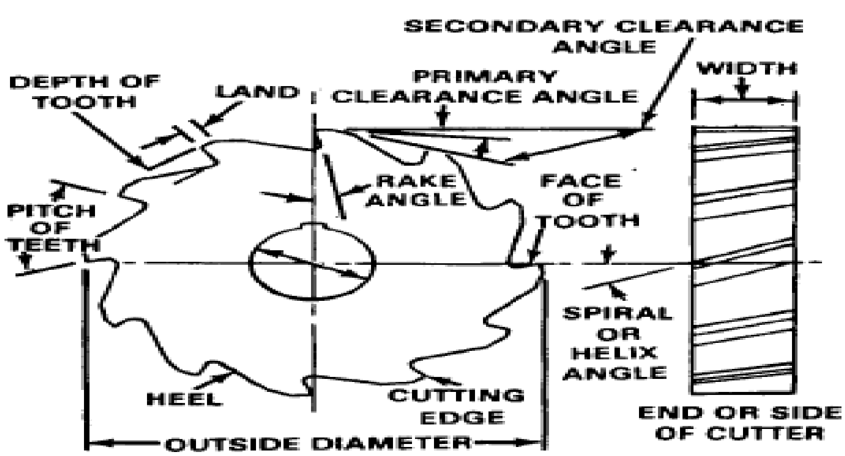
Plain milling machine, vertical milling machine, universal milling machine,

simplex milling machine, triplex milling machine

Type of Milling Cutter:

Plain milling cutter, slide milling cutter, arbor cutters, shank cutters, face cutters.

PROCEDURE:



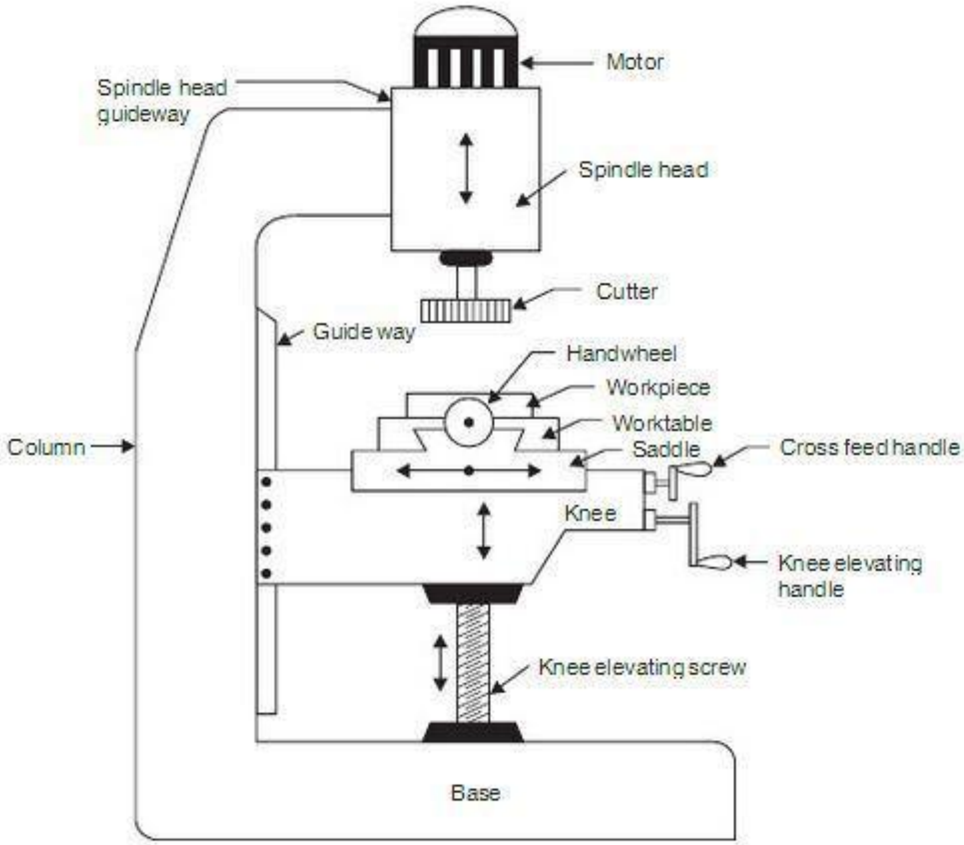


Fig. 4.10 Vertical milling machine

1. The raw blank is selected with reference to the number of teeth to be cut.
2. Indexing number is calculated to the position of the blank.
3. Gear blank is mounted on mandrel in milling machine.
4. Centering of the blank is done by upward and cross feed.
5. The depth of the cut is calculated for the given module.

Result: Thus the gear cutting is performed in a milling machine.

EXPERIMENT NO.2

OBJECTIVE: Bolt making on lathe machine

APPARATUS: cutting saw, center lathe, pedestal grinder, HSS tool bit and straight Or right hand tool holder, center drill, live center, stock and die, metal Work vice.

PROCEDURE:

Cut hexagonal material to length, with allowance for facing.

2. Face one end in the Centre Lathe to 90 mm length overall.

3. Centre Drill one end for the live center.

4. Hold the hexagonal bar in the 3 jaw chuck by around 5-8 mm with

the other end held by the live center.

5. Turn the 12 mm diameter for the thread x 80 mm long – measure

With the micrometer, size to finish at 12 mm minus 0.05 – 0.10.

6. Adjust the tool and clean up the corner for the head of the bolt.

7. Chamfer the 12 diameter end at 45 degrees x 2 mm.

8. Hold the 12 diameter in the chuck and chamfer the head at 45degrees.

9. Hold by the 12 diameter and start the thread using the Stock and Die

With the tailstock ensuring that the axis is square to the die – use cutting compound.

10. When sufficient has been cut to ensure the trueness of the thread,

Take it out of the lathe and finish the tread depth to 60 mm in the

metal working vice.

Result: Bolt by lathe machine has been prepared.

EXPERIMENT NO.3

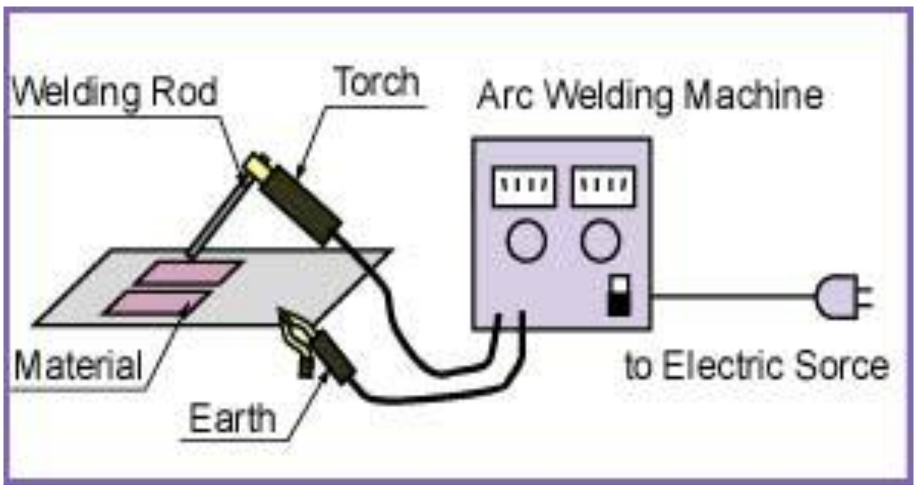
OBJECTIVE: Arc Welding experiment.

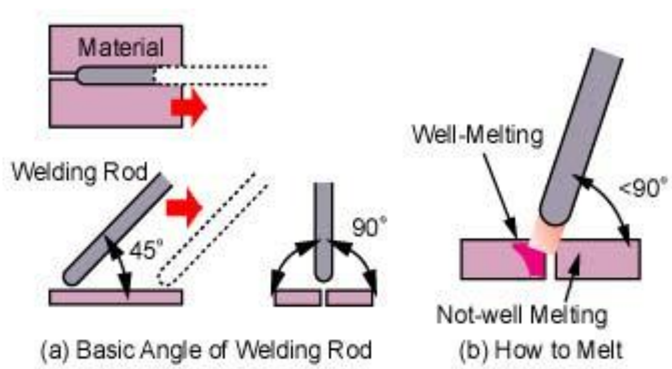
APPARATUS:

THEORY: Arc welding is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is usually protected by some type of shielding gas, vapor, or slag. Arc welding processes may be manual, semi-automatic, or fully automated.

Type of Arc Welding: Gas metal arc welding (GMAW), Flux-cored arc welding (FCAW), Submerged arc welding (SAW), Gas tungsten arc welding (GTAW)

PROCEDURE:





Angles of Welding Rod

1. Clean the metal before welding

2. Set the joint
3. Strike a welding arc
4. Build up a weld pool
5. Start moving the weld pool across the metal
6. Finish the weld
7. Clean the slag
8. Examine the weld
9. Allow the metal to cool

Result: Arc welding experiment has been performed.

EXPERIMENT NO.4

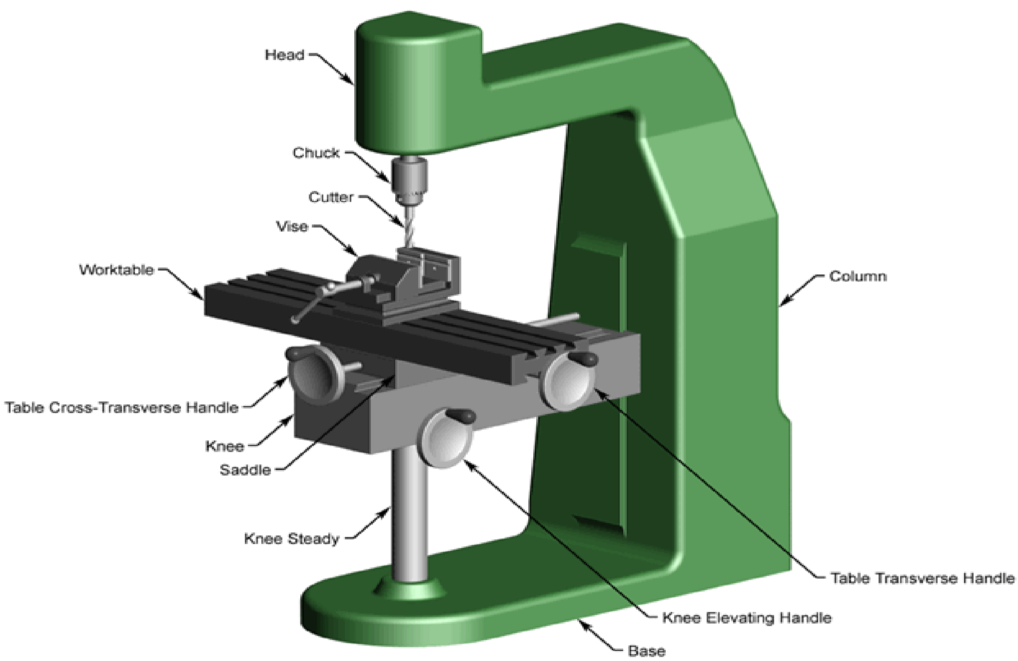
OBJECTIVE: Finishing of a surface on surface –grinding machine.

APPARATUS: Steel rule Try square, Vernier caliper

THEORY: Surface grinding machines are useful to produce and finish flat and plane surface.

Types of grinding machines: Transverse grinding, Plunger grinding

PROCEDURE: (take square section)



1.The given work piece is taken and checked for its dimensions.

2. The job is placed on the grinding magnet at opened position.

3. Then each face is grinded to the required accuracy by constant speed.

4. The job is removed from the required accuracy. It is checked by using vernier caliper and squareness is checked by using try square.

Result: Thus the square section is grinded to the required accuracy in grinding machine.

EXPERIMENT NO.5

OBJECTIVE: Machining a block on shaper machine.

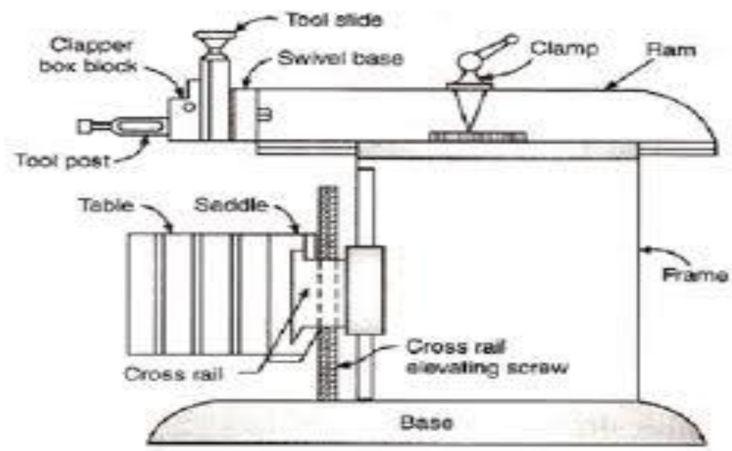
APPARATUS: Punching machine, Steel rule, Hammer, Shaper tool, Try Square

THEORY: The shaper is a reciprocating type of machine tool intended primarily to produce flat surfaces. These surfaces may be horizontal, vertical, or inclined.

The principal parts of a standard shaper are:

Base, Column, Cross rail, Saddle, Table, Ram, Tool head

PROCEDURE: (Square from round rod using Shaper)



1. The job was checked to the given dimensions.

2. The square was scribed in the outer circle of diameter of 50mm and Punching was done.

3. The job was attached in the vice of a shaper

4. The job was checked for perpendicular dimension.

5. Then the square from round was obtained in the shaper

6. The work piece was removed and burns are removed with accuracy was checked.

Result: Thus the square from round was performed on the given dimension in a shaper machine with the required dimensions.

EXPERIMENT NO.6

OBJECTIVE: Experiment on tool wear and tool life.

APPARATUS: milling machine, Drilling machine

THEORY:

Tool Life for milling Cutter

Tool life: Time of cutting during two successive milling or indexing of the tool. Tool life is the length of cutting time that a tool can be used or a certain flank wear value has occurred.

Taylor's tool life Equation

$$VT^n=C$$

V=Cutting speed, n=Cutting exponent, C= Cutting constant, T= tool life

n, C depends on speed, work material, tool material

Cutting speed can be obtained by:

$$N= (V*1000)/(\pi d)$$

Where N=spindle speed in rpm, V= cutting speed in m/min, d=diameter of cutting in mm

PROCEDURE: Determine the cutting speed by using d&N values.

Apply Taylor's equation and find tool life:

S.N.	n	C	d	N	V	T

Tool Wear of a cutting tool while drilling on drilling machine:

Tool wear are classified as

1. Gradual Wear- Crater wear, Flank wear

2. Catastrophic wear- Braking, Chipping

Three basic mechanism involve in tool wear

1. Adhesive wear

2. Abrasive wear-Two body, three body

3. Diffusion wear

Result: Thus tool life of milling cutter and study of tool wear of cutting tool on drilling machine is completed.

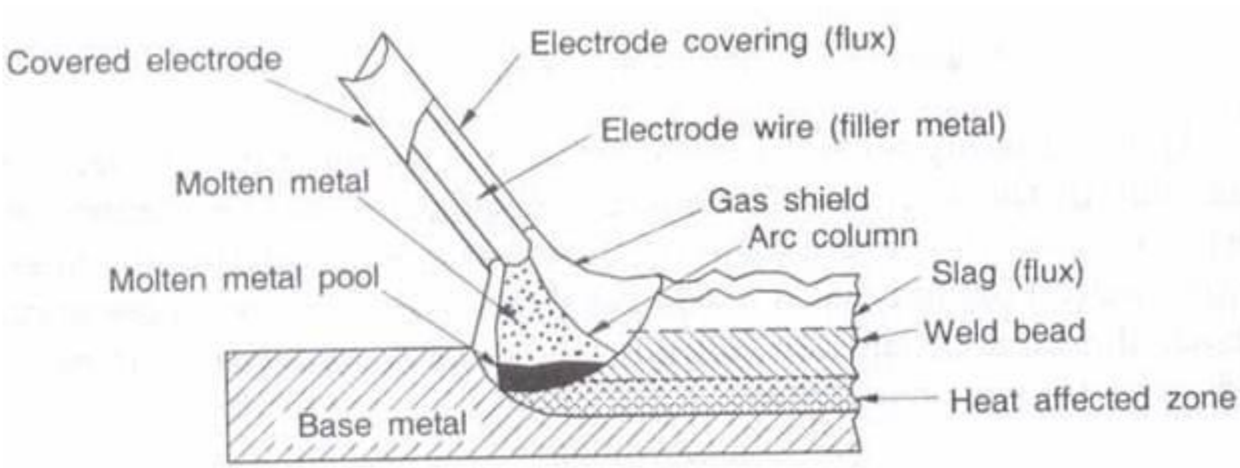
EXPERIMENT NO.7

OBJECTIVE: Soldering and Brazing Experiment.

APPARATUS: Soldering and brazing equipment

THEORY: Soldering accomplishes a strong bond between two pieces of metal by joining them together. In this procedure, a material called solder, an alloy mixture of tin and lead, flows over two pre-heated pieces of metal and holds them together. The process is similar to welding but differs because when you weld you are fusing and melting two pieces together to make one. When you solder you are essentially 'gluing' two parts together with molten metal. Most metals with the exception of aluminum, white metal and porous cast iron can be soldered.

PROCEDURE:



SOLDERING:

1. Prepare a work space. Lay down a mat or piece of cardboard that will catch any solder that you drip.

2.Warm your soldering iron. If your soldering iron is electric, you'll need to allow it to warm up on its stand. If your soldering iron runs on butane, as Master Appliance soldering irons do, fill it with gas holding the unit firmly with the refill nozzle pointed upwards and press down. Gas will overflow from nozzle when tank is full.

3. Secure the items you are soldering. It helps to have an extra hand while you are soldering. We suggest using a vise or frame to secure your work.

4. Clean your soldering iron. Because soldering irons get so hot, they oxidize and become dirty quickly. They key to reliable connections is clean components so make sure that your soldering tip and parts you are joining are clean. To accomplish this, pass the tip of your soldering iron on a wet sponge until it shines.

5. Apply flux. In soldering it often becomes necessary to use materials called fluxes to help remove oxides and keep them absent while you solder. Flux needs to melt at a temperature lower than solder so that it can do its job prior to the soldering action. There are different methods to apply flux. The method you choose will be dependent on the items you are soldering.

6. Tin your soldering iron. If you want to know everything there is to know about how to use a soldering iron, you'll need to know how to tin. Tinning is the process of coating a soldering tip with a thin coat of solder. Melt a thin layer of solder on your iron's tip. This aids in heat transfer between the tip and the component you are soldering, and also gives the solder a base from which to flow from. This process may need to be repeated as you solder. You will only touch the tip of the soldering iron to the solder when you tin. Do not touch the tip of the iron to the solder while you are actually soldering.

7. Start soldering. Hold the soldering iron like you would a pen in the hand you write with and the solder in the other.

8. Place the tip of the soldering iron tip. The tip needs to touch both the wire lead and the surface so they achieve the same temperature.

9. Feed solder onto the joint after you have heated the area for two to three seconds. Touch the solder to the side of the connection opposite the soldering iron. Then, let the solder flow only until the connection is covered.

10. Remove the solder first. Then, remove the iron. Make sure the joint remains stationary while it cools.

11. Evaluate. A smooth, shiny and volcano shaped joint is what you are looking for. If this isn't what you see, you'll need to reheat and feed in more solder.

12. Remove leftover flux with a commercial flux cleaner.

BRAZING:

1. Ensure fit and clearance

2.Clean metal

3.Flux prior to brazing

4.Fixturing of parts

5.Brazing the assembly

6.Cleaning the new joint

Result: Soldering and brazing experiment done.

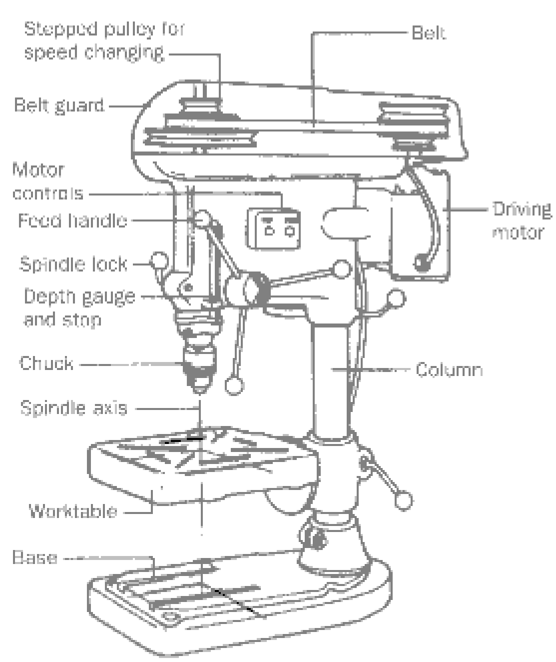
EXPERIMENT NO.8

OBJECTIVE: Drilling holes on drilling machine

APPARATUS: Drilling machine

THEORY: When drilling a hole using a hand or power drill, it can be tricky to drill the hole at a right angle to the work. Drills often have a level incorporated into the drill housing, but usually this requires good vision to read. There are, however, several techniques that persons with low vision or no vision use which can make drilling quite accurate. These techniques include:

Drill guides in a range of diameters are available from hardware stores or building supply centers. Placing the guide on the surface of the work to be drilled and inserting the bit through the guide makes it possible to drill a hole straight into the work. If you have access to a drill press, you can make a set of drill guides yourself by drilling holes of different diameters into small blocks of wood. These work just like the drill guides described above. If you don't have access to a drill press, you might ask a sighted friend to make drill guides using a portable drill with a built-in level.



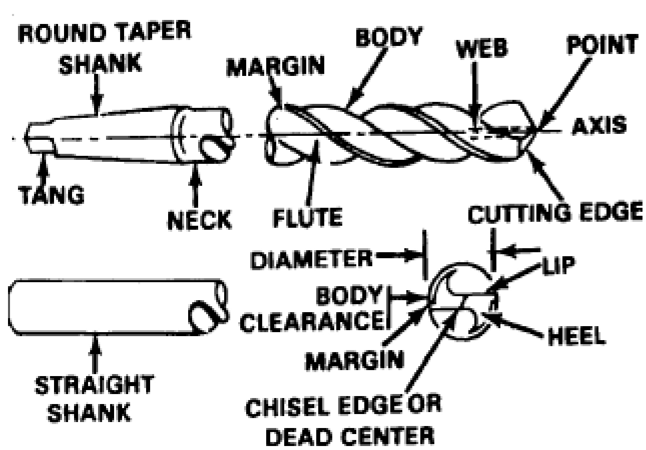
Tip: Over time, the guide hole in the wooden guide may become slightly enlarged, which may make it a bit more difficult to position the drill at exactly a 90 degree angle.

Remove a square or rectangle of wood from a board, creating a right angle; then place the bit into the corner to help align the bit.

Place a large-headed nail with the head down on the surface of the board, and align the bit with the nail by touch.

Use an empty spool of thread or sewing machine bobbin (pictured below). Mark the spot by making a "start hole" with an awl, nail, or ice pick. Place the drill bit through the spool or bobbin and align the point of the bit with the start hole you've created. With the drill in the "off" position, place the flat end of the spool or bobbin firmly against the surface and hold it in place with pliers. Please note: Do not use your hands to hold the spool in place. With the drill and spool in this position, start the drill – and your hole will be straight/perpendicular with the surface.

TWIST DRILL: Twist drills are rotary cutting tools normally having two cutting edges and two flutes which are grooves formed in the body to provide cutting lips, to permit the removal of chips and to allow coolant or cutting fluid to reach the cutting action. They are identified by the shank style, straight or taper, then by length, screw machine, jobber or taper length, by the material they are made from and finally by the helix or spiral of the flutes.



Result: Drilling operation has been performed.