LABORATORY MANUAL

II Year B. Tech II- Semester

MECHANICAL ENGINEERING

MANUFACTURING PROCESS LAB

R18A0384

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

(Autonomous Institution-UGC, Govt. of India)
Secunderabad-500100,Telangana State, India.
www.mrcet.ac.in

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech LAB TIME TABLE

YEAR: ____SEMESTER: ____ SECTION: ____ NAME OF THE LAB: _____

Day/ Period	**1** 9.20 AM – 10.20AM	**2** 10.20 AM – 11.10AM	**3** 11.10 AM – 12.00 PM	**4** 12.00 PM – 12.50 PM	12.50 PM 01.30 PM	**5** 1.30 PM – 2.20 PM	**6** 2.20 PM – 3.10 PM	**7** 3.10 PM – 3.50 PM
MON					**L U N C H**			
TUE								
WED								
THU								
FRI								
SAT								

LAB FACULTY :

TECHNICIAN (S) :

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MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

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Department of Mechanical Engineering

VISION

- To Become An Innovative Knowledge Center In Mechanical Engineering Through State Of The Art Teaching –Learning And Research Practices, Promoting Creative Thinking Professionals.

MISSION

- The Department Of Mechanical Engineering Is Dedicated For Transforming The Students Into Highly Competent Mechanical Engineers to meet the needs of the industry, by strongly focusing in the fundamentals of engineering sciences for achieving excellent results in their professional pursuits.

QUALITY POLICY

- To Pursuit Global Standards Of Excellence In All Our Endeavors Namely Teaching, Research And Continuing Educations And To Remain Accountable In Our Core And Support Functions, Through Processes Of Self-Evaluation And Continuous Improvement.

- To Create A Midst of Excellence For Imparting State Of Art Education, Industry-Oriented Training Research In The Field Of Technical Education.

(R18A0384) MANUFACTURING PROCESSES LAB

Course Objectives:

1. To know about the casting of different materials.
2. Study and Practice different welding processes.
3. To learn the operation of hydraulic press operation for different materials.
4. Understand the Process of blow and Injection Moulding.
5. To learn the Processing of different materials.

List of Experiments

1. To design and making of pattern - for one casting drawing.
2. To determine sand properties- Exercise -for strengths, and permeability.
3. To Prepare Mould for Casting.
4. To prepare a butt joint with the specimens by Arc Welding.
5. To join the sheets by Spot Welding operation.
6. To join the specimens by TIG welding process.
7. To perform Plasma welding and Brazing.
8. To perform blanking & piercing operation.
9. To perform deep drawing and extrusion operation.
10. To prepare the product by Injection Moulding machine.
11. To prepare the product by Blow Moulding machine.
12. Design & processing of IC Engine components by 3D printing

Note: Total 10 experiments are to be conducted.

Course Outcomes:

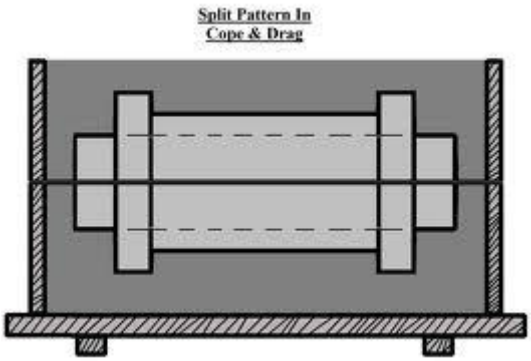
1. Learn about patterns and casting of metals.
2. Understand the concept of Arc, Spot, TIG welding and brazing process.
3. Understand the Process of simple, compound and progressive press and Hydraulic press
4. Learn the Moulding process of plastic materials
5. Understand the processing of different materials in the lab.

CONTENTS

1. Design and making of Pattern

Aim: To prepare a split wooden pattern detailed below with allowance.

Tools Equipment & Material: Steel rule, outside caliper, Mortise Chisel, inside chisel, peering chisel, Firmer Chisel, Wood rasp half round file, outside gauge, outside chisel, Try square, Handsaw, Mallet, Sandpapers, Teak Wood given size



Procedure: Match the two rectangular wood pieces of stock and fix them together by wood screws at either end in the excess portion of wood. This must give a firm clamping of the wood pieces to turn into single piece.

In body portion of the pattern mark a center link using marking gauge and extend it to the dressed end. Using the race with counter sunk make indentations at the center of each and to form locations for the head stock and tail stock center.

The wood stock is turned on the wood turning lathe using appropriate gauge and finally finished the dimensions.

Sanding paper No. ½ or No.0 does smooth finishing

The sand paper should be moved laterally on the rotating work.

Precautions:

1. The tools are kept sharp to cut freely without burning and also without much pressure to cause chipping.
2. Maintain proper turning angles.
3. Be alert to avoid accidents.

Result: The Required Split pattern is prepared

OBSERVATION

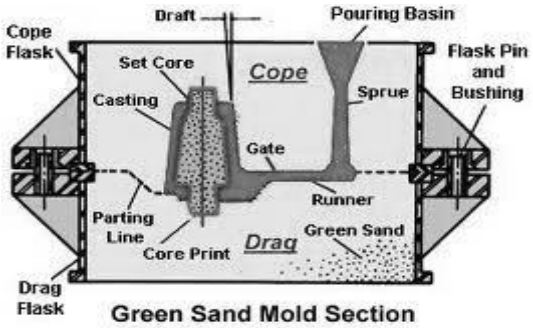
2. Mold Preparation, Melting and Casting

Aim: To prepare a green mould for casting using only two boxes.

Tools And Pattern: Wooden pattern is made in two halves, dowelled together, the division passing through the center of the grooves; cope and drag moulding tools parting sand, brick dust etc.

Stage Sketches:

The mould can be prepared by using three boxes without any difficulty. However the same can be prepared using two boxes using an ingenious method known as false-core method.



Green Sand Mold Section

Procedure:

1. One half of the pattern is molded in the bottom box, the parting being cut an incline as shown. The other half pattern is then placed in position and sand poured and rammed to form the second parting with a slope down wards from the upper flange of the pulley
2. The top box is next placed on the bottom box and properly located. Sand is poured and rammed without damaging the false core.
3. The top box is gently removed; the upper half pattern is gently taken out from the top box.
4. The top box is replaced on the drag and the entire mould is turned upside down. The bottom box, which now is at the top, is gently lifted and the remaining half of the pattern is withdrawn.
5. The bottom box is replaced and the mould id inverted. The spruces are removed, pouring basin is cut and the mould is finished after piercing holes (vents).

Observations:

1. After ramming using moulds hardness tester check the mould hardness on all the four sides of the pattern.
2. Locate the rumen and riser 90^0 exactly.

Precautions:

1. Ramming should be uniform to impart uniform strength to the mould.
2. Apply parting sand at the partitions for esy separation of boxes.
3. Locate the two halves of pattern properly to avoid mismatch.

Result: Sand mould is prepared for the given pattern.

Melting Procedure For Aluminum Alloys:-

The charge materials, chemicals should be free from moisture, oil, and corrosion powder and should be preheated before charging. The calculation of charge should be done considering the melting loss of each element in the melting furnace for final desired analysis.

1. The furnace crucible should be clean and red hot for charging.
2. Aluminium alloys get readily oxidized and form dross, using proper covering top with flux and chemicals help to reduce this. Different proprietary chemicals are available for different alloys.
3. Melting should be done under steady conditions without agitation. Stirring is done to reduce gas pickup.
4. Once melting is complete, degassing using solid chemicals like hexachloro-ethane which evolves chlorine by purging with nitrogen or argon gas is done to remove the dissolved hydrogen. Hydrogen is evolved from moisture.

$$3H_2O+2Al \rightarrow Al_2O_3+6H$$

Hydrogen absorbed by liquid metal causes serious porosity in casting during solidification.
Degassing should be done in the temperature range 730^0 C to 750^0 C

5. Liquid metal after degassing is treated with sodium containing chemicals to improve mechanical properties.
6. Liquid metal once ready should not be super heated. Agitated or kept long in the furnace which will cause dressing and gas pickup. Dross should be skimmed properly before pouring.
7. Alloys containing magnesium should be melting carefully as it is highly reacting. Special fluxes and chemicals like sulphur are used to inhibit the reactivity and prevent spontaneous ignition, melting loss and dross.

Casting Defects Due To Improper Melting:

1. Improper chemical analysis: Incorrect charge, calculations, including wrong estimates of melting losses, metal recovery, excessive losses due to improper fluxing and slogging operations, improper covering of non-

Ferrous melt causes this defect.

2. Gassy metal/hydrogen pickup/pinhole porosity: unclean melting causes formation and absorption of hydrogen into liquid metal. As casting solidifies, the absorbed hydrogen losses solubility and forms cavities inside casting.

3. Oxygen absorption

Excessive oxygen furnace operations in atmosphere following oxidation during melting cause this defect. It also causes loss of costly metal added in the charge.

4. Slag inclusions

Improper fluxing and slag removal slag particles to be mixed in the metal being poured. Careless pouring, lip pouring for alloys with fluid slag causes slag particles to enter casting.

5. Cold shut, misrun, unfilled castings

Low pouring temp, delay in pouring, due to many folds being poured, loss of heat from lable, due to improper covering failure of ladle opening in the bottom pouring cause premature solidification of metal causing defects.

6. Sand fusion, metal penetration, rough surface

Excessive pouring temp of liquid causes damage to the casting surface by attacking mould surface.

7. Sand erosion sand inclusions

Uncontrolled high pouring rate from ladle into mould leads to erosion of mould/core

PRECAUTIONS:

1. The furnace crucible should be clean and red hot for charging
2. Charge material should be free from oil, moisture etc.,
3. Melting must be done under steady condition to reduce gas pickup.

RESULT:

Melting practice is observed.

Applications:

- Transport : Automobile, aerospace, railways and shipping
- Heavy Equipment : Construction, farming and mining
- Machine Tools : Machining, casting, plastics molding, forging, extrusion and forming
- Plant Machinery : Chemical, petroleum, paper, sugar, textile, steel and thermal plants
- Defence : Vehicles, artillery, munitions, storage and supporting equipment
- Electrical Equipment Machines : Motors, generators, pumps and compressors
- Hardware : Plumbing industry pipes, joints, valves and fittings
- Household : Appliances, kitchen and gardening equipment, furniture and fittings
- Art Objects : Sculptures, idols, furniture, lamp stands and decorative items

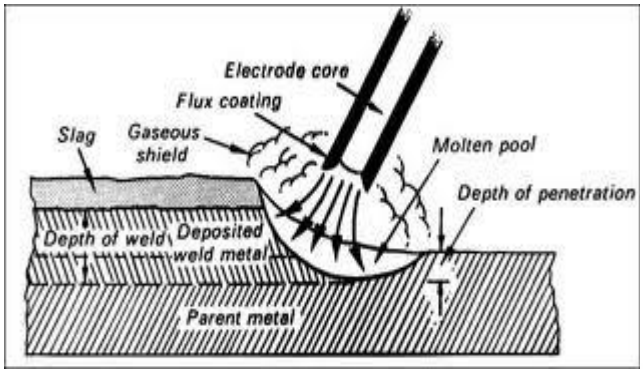
OBSERVATION

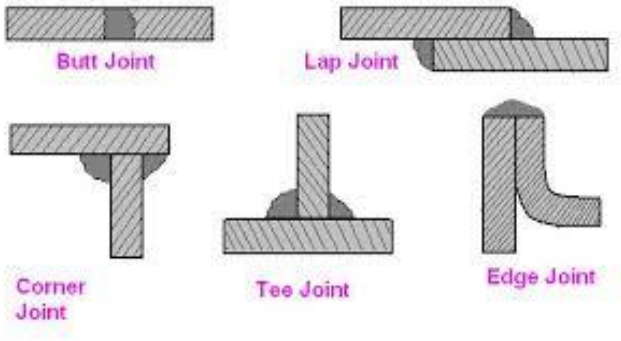
3. ARC WELDING

Aim: To prepare a butt joint with the specimens by Arc Welding.

Equipment and Material Required: D.C Welding machine, Bench vice, Tensile testing machine, M.S. Plates of 100x50x5(2), Metallurgical microscope.

Tools Required: Hack saw, Chipping hammer, wire brush, safety goggles, Hand gloves, Face shield, Files.





Procedure:

1. Given 2 M.S. plates are filled at an angle of 45^0 at 2 surfaces to be joined (V groove is formed)
2. Electrode is fixed to electrode holder.
3. Connections to be given such that electrode- negative and work piece positive.
4. Welding is to be done carefully for the half-length of the plates.
5. The work piece is to be cut into two halves by power hacksaw.
6. The beads are polished, etched with two percent natal solution and studied under the microscope whose magnification factors 10X for the heat effected zone.
7. By gripping the beads b/w the jaws pf Tensile testing machine and load is applied until the work piece breaks and the readings is to be noted.
8. The same procedure is repeated for the remaining half which is welded by reverse polarity and the results are to be compared

Precautions:

1. Edge preparation should be done very carefully.
2. Before welding ensure the surfaces are extremely clean.
3. While welding always use face shields or goggles.

Result: The effect of polarity on weld strength and heat effected zone in arc welding was studied.

APPLICATIONS OF WELDING:

Industries: Welding processes are a foundational aspect of all large-construction industries, ensuring strong, sustainable connections within buildings, bridges and other infrastructures.

Electrical:In the electrical and electronics industries, discharge capacitor (DC) welds are preferred for use with the thinner sheet metals associated with smaller, more delicate electronics systems. This welding option is used throughout the electrical system build-out process in numerous specialty applications, such as medical labs and small appliance fabrications. CD welding neatly bonds components like switchboards and switches in cabinets and on panels, fix fascia panels, add buttons and instruments, and attach printed circuit boards.

Mechanical:For more rugged applications that involve thicker metal dimensions, arc stud welding provides the control and effectiveness necessary to firmly bond heavier pieces together. In the automotive industry, arc welds bond heat shields, exhaust systems and hydraulic lines to the chassis. Metal furniture pieces like office desks, file cabinets and shelving units are often welded. Heating, ventilation and air conditioning units are usually constructed using welding processes.

Shipbuilding: Welding has been the traditional shipbuilding construction method used since the advent of the Industrial Age. Ensuring a water-tight surface is essential. Inside the ship, welding processes secure hatches, fluid lines, control panels and many other components critical to a safe and seaworthy vessel.

Equipment: Most, if not all, of today's industries rely on properly functioning equipment, and welding processes are vital to the success of those machines.

Farm equipment: In agriculture, farm machines that plow, plant, seed and harvest are fundamental to the country's food supply. Those machines are welded throughout their frames and processes. On the chassis, the cab frame, fenders and brackets are formed by welds. Motor structure and electrical functions are fused, as are the features of specialized tools such as threshers and spreaders.

Lawn and garden: Lawn mowers, trimmers, power saws and other garden equipment have long lives due to the strength of their welded frames. Other metal garden features enhance the enjoyment of outdoor life, such as barbecue grills, enclosures, seating and watering systems.

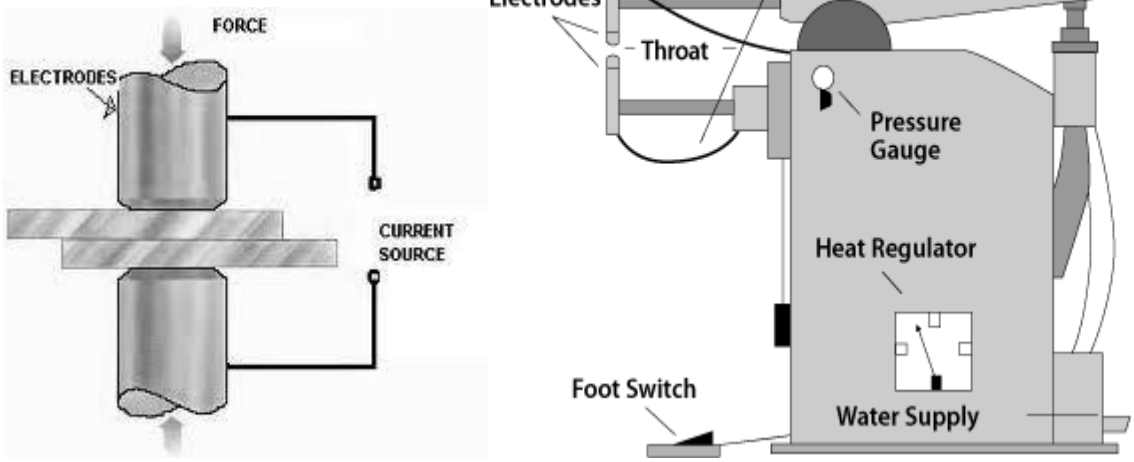
OBSERVATION

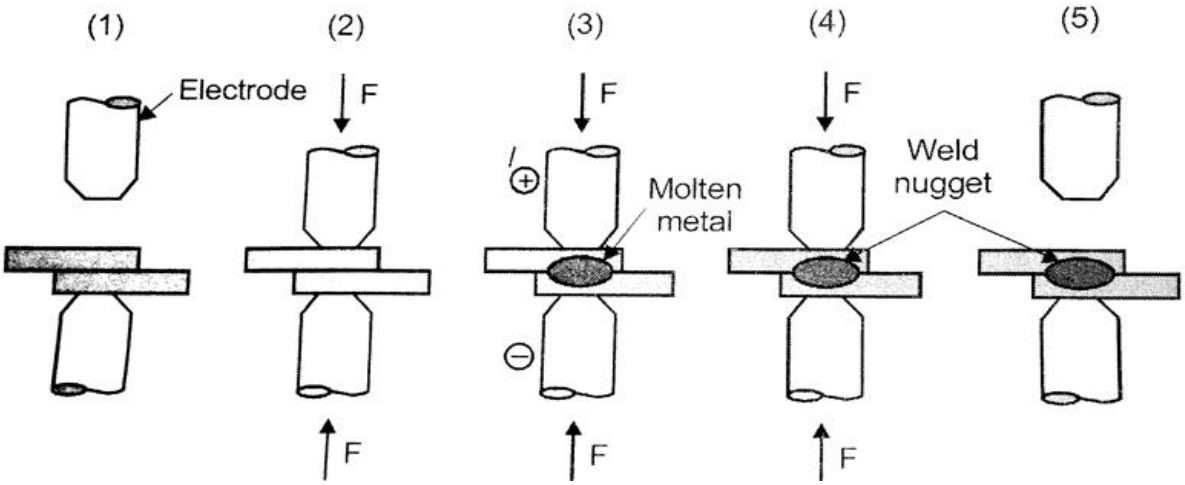
4. SPOT WELDING

Aim: To spot welding process on two sheet metal pieces.

Equipment: Spot welding machine

Material required: Two metal pieces of size 4”x2”





Process of spot welding

Description of the Equipment:

A typical resistance spot welding machine essentially consists of two electrodes, out of which one is fixed. The other electrode is fixed to a rocker arm (to provide mechanical advantage) for transmitting mechanical force from a pneumatic cylinder. This is simplest type of arrangement. The other possibility is that of a pneumatic or hydraulic cylinder being directly connected to the electrode without any rocker arm.

For welding large assemblies such as car bodies, portable spot welding machines are used.

Here the electrode holder and the pneumatic pressurizing system is present in the form of a portable assembly which is taken to the place, where the spot is to be made. The electric current, compressed air and the cooling water needed for the electrodes is supplied through cable and hoses from the main welding machine to the portabe unit.

In spot welding, a satisfactory weld is obtained when a proper current density (A/Sq mm) is maintained. The current density depends on the contact area between the electrode and the work piece. With the continuous use, if the tip becomes upset and the contact area increases, the current density will be lowered and consequently the weld is obtained over a large area. This would not but able to melt the metal and hence there would be no proper fusion.

A resistance-welding schedule is the sequence of events that normally take place in each of the welds. The events are the squeeze time is the time required for the electrodes to align and clamp the two work pieces together under them and provides the necessary electrical contact.

The weld time is the time of the current flow through the work pieces till they are heated to the melting temperature.

The hold time is the time when the pressure is to be maintained on the molten metal without the electric current. During this time, the pieces are to be forge welded.

The off time is time during which, the pressure on the electrode is taken off so that the plates can be positioned for the next spot. The off time is not normally specified for simple spot welding, but only when a series of spots are to be made in a predetermined pitch.

PROCEDURE:

1. Switch on the machine and set the current in the machine to 2 Ampere
2. Set the timer to two seconds
3. Over lap the two metal pieces to the requires size and place them between the two electrodes.
4. Apply pressure by foot on the lever such that two electrodes come into contact if the over lapped metals.
5. After 2 seconds remove the pressure on the lever slowly.
6. Now the joint is ready for use.
7. Repeat the same procedure at various amperes
8. Test the strength of the joints using universal testing machine.

PRECAUTIONS:

1. Ensure that the electrodes should not be touched.
2. Don’t touch the welded potion by hand immediately after the welding is done.

Result: Effect of current on strength of spot weld is studied.

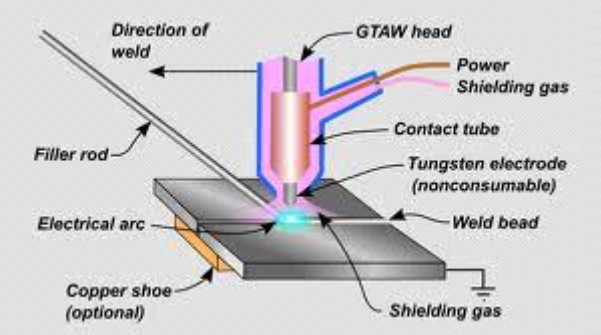
OBSERVATION

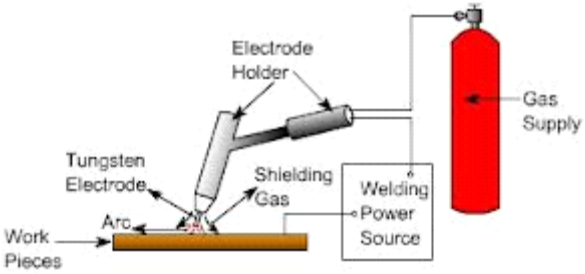
5. TIG WELDING

Aim: To make butt-Welding using TIG welding equipment.

Equipment And Material Required:
Inert gas(helium,argon) welding outfit, MS Sheets 150x50x5mm (2No)

Tools Required: Wire brush, hand gloves, and chipping hammer, spark lighter.





Procedure:
1. Inert gas valve on the torch is opened slightly and lightened with the help of a spark lighter.
2. The torch tip is to be positioned above the plates so that white cone is at a distance of 1.5mm to 3mm
   from the plates.
3. Torch is to be held at an angle of 30^0 to 45^0 to the horizontal plane.
4. Now filler rod is to be held at a distance of 10mm from the flame and 1.5 mm to 3 mm from the surface of the weld pool.
5. As the backward welding allows better penetration, back ward welding is to be used.
6. After the completion of welding, slag is to be removed by means of chipping hammer, wire brush.

Precautions:
1. Ensure that torch movement is uniform.
2. See that the joints are extremely clean.

Result: A butt joint is prepared using gas welding process.

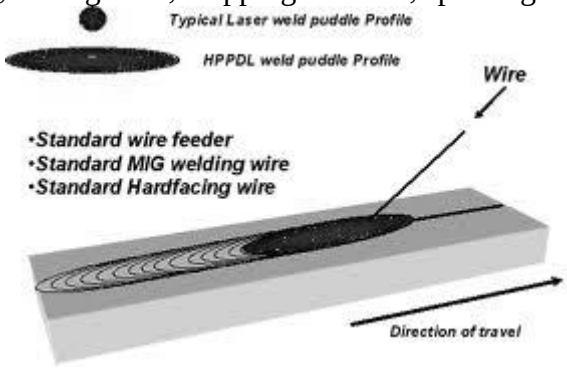
OBSERVATION

6. BRAZING

Aim: To join two sheets by brazing process.

Equipment And Material Required:
Oxy-acetylene torch, flux, filler rod, GI sheets 150x150x1mm

Tools Required: Wire brush, hand gloves, chipping hammer, spark lighter.



Description:

Brazing is coalescence of a joint with the help of a filler metal whose melting temperature is 450^0C and is below solidify temperature of the base metal. The filler metal is drawn into the joint by means of capillary action.

Procedure:

1. The surface to be joined is cleaned properly.
2. Sheets are joined and laid by giving proper clearance.
3. Flux is applied to the joint.
4. Joint is to be heated by using welding torch to heat the filler metal to its melting temperature when the filler material is placed at the joint.
5. The filler material is flown into the service by capillary action and joint is made.

Precautions:

1. As the filler metal fills the joint by capillary action, give only needed clearance.
2. See that the joints are extremely clean.

Result: Two sheets are joined using brazing process.

OBSERVATION

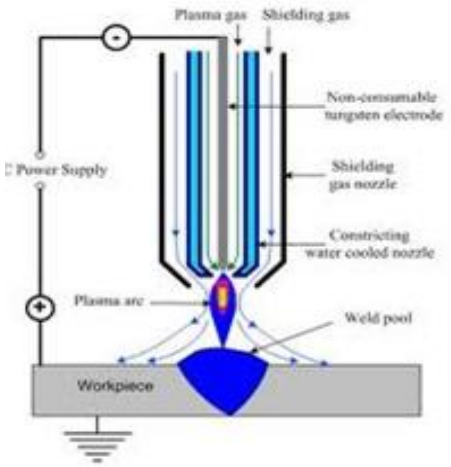
7. PLASMA ARC WELDING

Aim: To Join two given work pieces using plasma arc welding and Brazing and cut the given plate into two parts using plasma cutting.

Apparatus required:

Plasma Arc Welding System

Material Required: MS flat 50x50x10 mm –3 Nos



Plasma Welding

Procedure:

1.The edge of the given material is prepared to the required V-shape using grinding machine

2. The machine is set to the required parameters(For Welding).

3. Place the two work pieces on the table with required position as shown in figure.

4. The work pieces are kept in the required position and tack welding is performed on the work pieces.

5. First run of welding is done to fill the gap and penetration of the weldment by holding the electrode at about 700 and filler rod at 300and move the electrode to another end uniformly.

6.Second run of welding is done with proper weaving and uniform movement so that a uniform weld bead will be obtained.

7.The scale formed is chipped with chipping hammer.

8. Filing is done to remove any spatter around the weld.

9.The machine is set to the required parameters(For Cutting)

Precautions:

1.Never look at the arc with the naked eye. Always use a shield while welding.

2.Always wear the safety hand gloves, apron and leather shoes.

3.Ensure proper insulation of the cables and check for openings.

4.Care is taken to avoid arc blow, which will cause serious defect in the weldment.

Result: The required butt joint is prepared by Plasma Arc Welding.

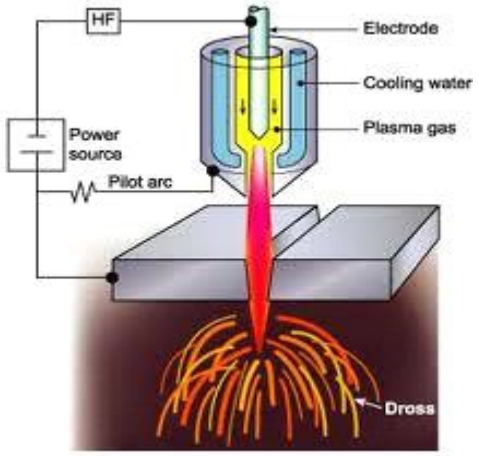
OBSERVATION

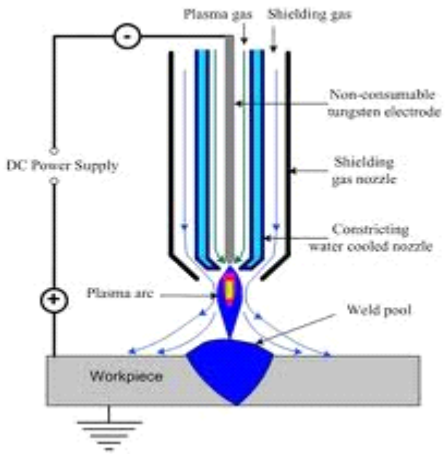
8. PLASMA CUTTING

Aim: To cut a given specimen using plasama cutting equipment.

Equipment And Material Required:
plasama cutting equipment **,**MS Sheets 150x50x5mm

Tools Required: Wire brush, hand gloves, and chipping hammer, spark lighter.





Plasma cutting Plasma Welding

Procedure:
1 Gas(helium or hydrogen) valve on the torch is opened slightly and lightened with the help of a spark ligh ter.
2. Now ionized gas are forced through the arc and nozzle (at aflow rate of 1.5 to 15 litres per min) with the result that these get ionized and become plasma
3. The torch tip is to be positioned above the plates so that white cone is at a distance of 1.5mm to 3mm from the plate .
4. Torch is to be held almost vertical to the base metal sur face for cutting,
5. Torch is to be held almost vertical to the base metal surface and filler metal wire fed at angle for Welding
5. Now filler rod is to be held at a distance of 10mm from the flame and 1.5 mm to 3 mm from the surface of the weld pool.
6. As the backward welding allows better penetration, back ward welding is to be used.
7. After the completion of welding, slag is to be removed by means of chipping h ammer, wire brush.

Precautions:
1. Ensure that torch movement is uniform.
2. See that the joints are extremely clean.

Result: A butt joint is prepared using plasma welding and a given piece is cut by plasma cutting

OBSERVATION

9.POWER PRESS

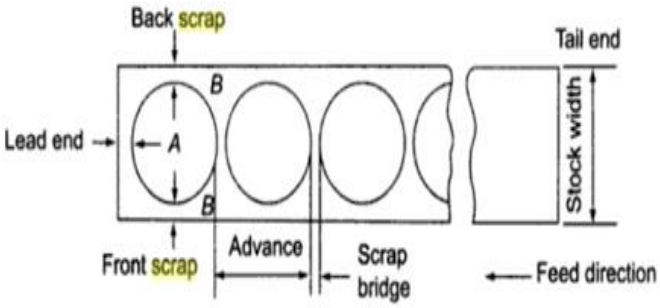
Aim: To perform blanking & piercing operation and study of simple, compound and progressive press tool.

Equipment and tools required:

- Power press machine
- Punches
- Steel Rule

Material Required:

Specimen of mild steel 250 X 12 X 2mm



Procedure:

- Take a steel of strip of given dimension and punch the holes
- Place the strip is available slot in the machine
- Punch holes on each side by pressing the lever
- After completing on one side report the same on other side

Precautions:

- Care is taken while handling the rotating parts
- Check that lubrication is done properly

Result:

The object is made by power press by using die punch to required shape

OBSERVATION

10. HYDRAULIC PRESS

Aim: To perform deep drawing and extrusion operation using Hydraulic press.

Equipment: Hydraulic Press, Compound Die, Progressive Die, Deep-Drawing Die.

Raw Material: Mild Steel

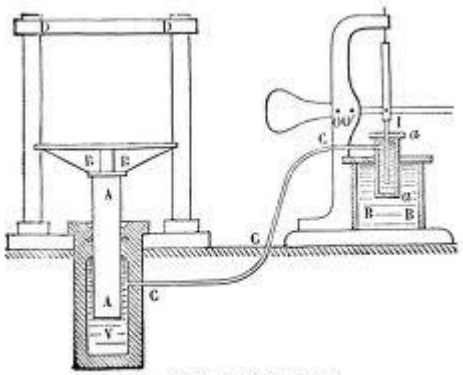


Fig. 2. Presse hydraulique.

Description of the equipment: Presses are classified in various ways. They may be classified according to

i. Source of power

ii. Method of actuation of the rams (slides)

iii. Number of slides

iv. Types of frames

v. The type of work for which the press has been designed.

Source of power:

Two kinds of sources of power supply to the ram: Mechanical and hydraulic.

Mechanical presses, the energy of flywheel is utilized which is transmitted to the work piece by gears, cranks, eccentrics or levers.

The flywheel rotates freely on the crankshaft and is driven from an electric motor through gears or v-belts. The motors runs continuously and stores energy in the flywheel. When the operator presses a foot treadle or actuates a button, the clutch gets engages and the flywheel is connected to the crankshaft. (Driveshaft). Starts rotating and the stored up energy in the flywheel is transmitted to the ram on its downward stroke. The clutch to engage and disengaged the flywheel to the drive shaft can be; a Jaw clutch and the air operated clutch or an electromagnetic clutch. In manually operated mechanical presses, the clutch is disengaged to each cycle. But in automatic presses in which the metal strip is fed to the die automatically, there is no need of single stroke clutch. Disengaging mechanism and the ram moves up and down continuously. These presses can be classified as plain and geared press, the flywheel is carried on a auxiliary shaft which is connected to the main shaft. Through one or more gear reduction, depending

upon size and energy needed. In this arrangement, the flywheel stores considerably more energy than the plain as its speed is higher than the main drive shaft.

In Hydraulic press, the ram is actuated by oil pressure on a piston in a cylinder.

Mechanical presses have following advantages over the hydraulic presses.

1. Run faster
2. Lower maintenance cost
3. Lower capital cost.

Procedure:

1. Set the compound die or progressive die or deep drawing die in the required position.
2. Switch on the motor to start the machine.
3. Pass the MS sheet in to the progressive die/compound die. In case of deep drawing
4. Apply injection pressure using direction control valve.
5. The plunger punches the sheet into the mosquito coil stand/washer lid shape.
6. Release injection pressure.
7. Take out the finished product from the die.

Precautions:

1. Do not apply too high injection pressure
2. Proper lubrication must be done between moving parts of die and press
3. Operate the hydraulic press carefully.

Result: Mosquito coil stand/Washer/lid is prepared using corresponding die un hydraulic press.

Advantages of hydraulic press:

1. More versatile and easier to operate
2. Tonnage adjustable to zero to maximum
3. Constant pressure can be maintained through out the stroke
4. Force and speed can be adjusted through out the stroke.
5. Safe as it will stop at a pressure setting.
6. The main disadvantages of hydraulic press is that it is slower than a mechanical press.

A press is rated in tones of force; it is able to apply with out undue strain. To keep the deflections small, it is a usual practice to choose a press rated 50 to 100 percent higher than the force required for an operation.

Limitations of Hydraulic Press:

1. The initial capital cost is higher compared with drop forging, because the cost of crank press is always higher than that of an equivalent hammer.

2. The difficulty of descaling the blank is another short coming of this process.

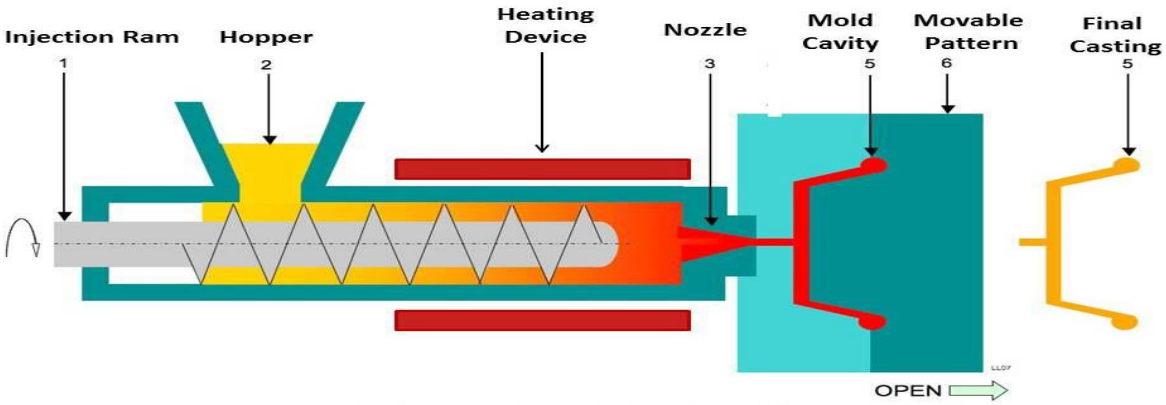
3. The process is economically suitable only when the equipment is efficiently utilized.

OBSERVATION

11 INJECTION MOULDING MACHINE.

Aim: To Prepare a Plastic product using Injection Moulding machine

Equipment: Injection moulding machine.



Injection Moulding Machine

Material Required: High grade poly ethylene

Description of The Equipment:

Hydraulic Plastic Injection Moulding machine, Model JIM-1HD has been designed for moulding variety components up to 45 Gms capacity in polystyrene. The machine is robustly built to ensure consistent high quality and volume production of precision components. Operator fatigue due to injection process is completely eliminated by use of hydraulic power for both the injection and releases operations.

Locking Unit: This locking made by Hydraulic Cylinder.

Injection Unit: Injection Unit consists of two guide rods, nuts, top and bottom plates with injection cylinder and barrel. Injection cylinder is designed to develop 3 Tons load. Barrel diameter 30mm is attached with the machine as standard.

Hydraulics: Hydraulic pump is driven by 3 HP Induction motor for a rated delivery of 14 lp, at 1440 Rpm and at 80kg/cm^2. The maximum pressure in the hydraulic system is present in our works and is not to be altered. The oil tank capacity is 60 liters. All hydraulic system manufacturers safety precautions are provided to hydraulic system by using section strainer, which will prevent the contamination entering into the system.

Oil Cooler: Oil cooler provided to keep the oil temperatures below 50^0c which will gives more life to hydraulic oil in continuous use.

Electricals: Electrical control panel with automatic blind temperature controller is fixed on the right hand side of the machine for clear viewing of the temperature and for easy to operate the switches. Designed with safety measure, which will protect the motor from over load.

Working Procedure:

Injection moulding makes use of heat softening characteristics of thermo plastic materials. These materials soften when heated and re harden when cooled. No chemical change takes place when the material is heated or cool. For this reason the softening and re hardening cycle can be repeated any no. of times.

1. The granular moulding material is loaded hopper where it is metered out in a heating cylinder by a feeding device.
2. The exact amount of material is delivered to a cylinder, which is required to fill the mould completely.
3. Set the die in position Provide spacing plates if necessary. Clamping the Die using hydraulic operate ram.
4. Set the injection pressure by rotating (clockwise) the regulator knob to suit the requirement of moulding the container.
5. Switch on the heater. Set the required timings to the timers, for top and middle heater**.** Set the temperature by adjusting automatic temperature controller to control the bottom heater. Allow sufficient time to stabilizer. When temperature reached, operate the hand lever valve to inject the material.
6. Apply injection pressure on the heated material using plunger rod.
7. The injection ram pushes the material in to the heating cylinder and in doing so pushes a small amount of heated material out of the other end of the cylinder through the nozzle and screw bushing and into the cavity of closed mould.
8. The material is cooled in a rigid state in the mould.
9. Release the injection pressure. In clamp the Die using hydraulic operated ram.
10. The mould is then opened and piece I ejected out.

Result: Required product is made using injection moulding machine.

OBSERVATION

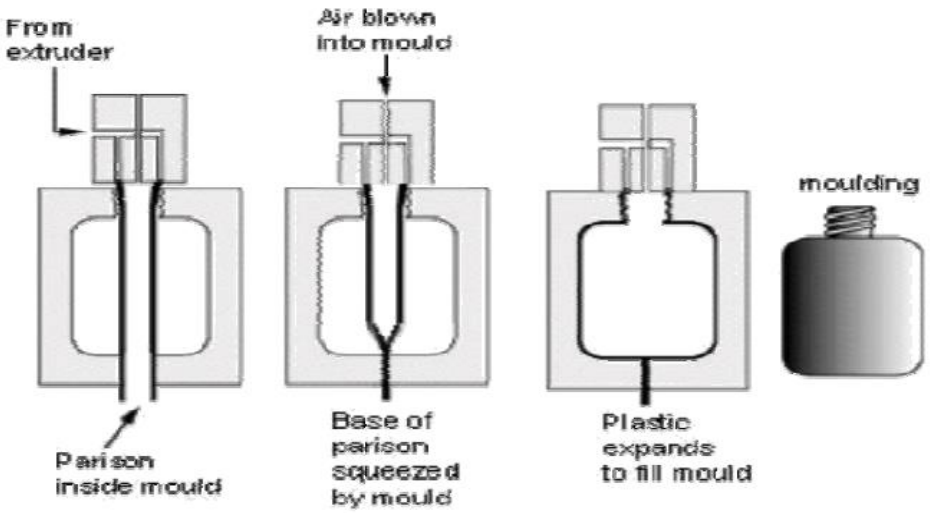
12. BLOW MOULDING MACHINE.

AIM: To prepare a bottle of 200ml using blow moulding machine.

APPARATUS REQUIRED: Die, blow-moulding equipment, air compressor.

MATERIALS REQUIRED: Plastic pellets

TOOLS REQUIRED: Blow Molding machine, grained plastic, Die (bottle shaped)



PROCEDURE:

1. Set the die in position. Adjust the guide rod nuts to suit die height. Align the tapered face of the die for sealing the parison while blowing also checks for the face opening and closing of the die.

2. Ensure minimum die height is 80mm. provide spacing plates if necessary.

3. Set the injection, release and blow pressure by rotating (clockwise) the regulator knob to suit the requirement of moulding the container.

4. Feed correct quantity & quality of plastic material and switch on the power supply.

5. Switch on the heater.

6. Set the required timings controller to control the bottom heater.

7. Allow sufficient time tostabilizer.

8. When temperature reached, operate the hand lever valve.

9. Extrude the parison (Tubular form) to the required length and close the two die halves. Release the injection cylinder.

10. Operate the hand lever valve and blow the air so that the parison to form the shape of the container as designed in the die.

11. Allow the component to cool.

12. Open the die & take the product out of the die.

13. Now the machine is ready for nest cycle.

PRECAUTIOS:

1. The material should not be heated rapidly.
2. The die should be placed exactly below the nozzle.
3. Proper temperature should be maintained while heating the plastic.

RESULT: Required product is made using blow moulding process.

OBSERVATION

13.SAND PROPERTIES TESTING

AIM: To Determine the Grain size, Permeability and Compressive Strength of the Moulding Sand.

APPARATUS REQUIRED: Sieves of different numbers and cubical block

EQUIPMENT REQUIRED:

Sieve Shaker, Permeability Apparatus and Compression Strength Testing Machine.

MATERIAL REQUIRED: Moulding Sand.

THEORY:

PROPERTIES OF MOULDING SAND:

Moulding sand must possess some properties like permeability, flowability collapsibility, adhesiveness, cohesiveness or strength and refractoriness. The properties are determined not only by the chemical composition, but by the amount of clayey matter in the sand, by its moisture content, and lastly by the shape and size of the silica sand grains.

Porosity: Molten metal always contains a certain amount of dissolved gases, which are evolved when the metal freezes. Also, the molten metal ,coming in contact with the moist sand, generates steam or water vapour .If these gases and water vapour evolved by the moulding sand do not find opportunity to escape completely through the mould they will form gas holes and pores in the casting. The sand must, therefore, be sufficiently porous to allow the gases or moisture present or generated with in the moulds to be removed freely. When the moulds are poured. This property of sand is called porosity or permeability.

Flowability: Flowability of moulding sand refers to its ability to behave like a fluid so that, when rammed it will flow to all portions of a mould and pack all-round the pattern and take up the required shape. The sand should respond to different moulding processes. Flow ability increases as clay and water content increases.

Collapsibility: After the molten metal in the mould gets solidified the sand mould must be collapsible so that free contraction of the metal occurs, and this would naturally avoid the tearing or cracking of the contracting metal.

Adhesiveness: The sand particles must be capable of adhering to another body, i.e.. they should cling to the sides of the moulding boxes. It is due to this property that the sand mass can be successfully held in a moulding box and it does not fall out of the box when it is removed.

Cohesiveness or Strength: This is the ability of sand particles to stick together. Insufficient strength may lead to a collapse in the mould or its partial destruction during conveying, turning over or closing. The closing may also be damaged during pouring the molten metal. The strength of moulding sand must, therefore, be sufficient to permit the mould to be formed to the desired shape and to retain this shape even after the hot metal is poured in the mould. This property of sand in its green or moist state is known as green strength. A mould having adequate green strength will retain its shape and will not distort or collapse even after the pattern is removed from moulding box. The strength of sand that has been dried or baked is called dry strength .It must have then strength to withstand erosive forces due to molten metal, and retain its shape.

Refractoriness:-The sand must be capable of withstanding the high temperature of the molten metal with out fusing. Moulding sands with poor refractoriness may burn on to the casting. Refractoriness is measure by the sinter point of the sand rather than its melting point.

SAND TESTING:

Grain Size:

Grain size of sand is designated by a number called "Grain Fineness Number" that indicates the average size as well as proportions of smaller and larger grains in the mixture.

The apparatus required for determining grain fineness consists of a number of standard sieves mounted one above the other, on a power driven shaker. The shaker vibrates the sieves and the sand placed on the top sieve gets screened and collects on different sieves depending upon the various sizes of grains present in the moulding sand.

In this test place five standard sieves mounted one above the other on a stand and under the bottom most sieve is placed a pan. The top sieve is the coarsest and bottom most sieve is the finest of all the sieves.

1. A sample of dry sand is placed in the upper most sieve and place the sieve stand on the vibrator.
2. Then vibrate the sieve stand for a definite period of time.
3. An amount of sand may be retained on each sieve and same is weighed.
4. Calculate the AFS grain fineness number.

Sieves – Mesh	% of Sand retained	Factor	Product of col.2 & 3

$$\text{AFS Grain Fineness number} = \frac{\text{Sum of products}}{\text{Total number of percetage of sand retained on pan and each}}$$

PERMEABILITY TEST:

1. 2000 cc of water held in the inverted bell jar is allowed to pass through the sand specimen.
2. A situation comes when the liquid entering the specimen equals the air escaped through the specimen.
3. This gives a stabilized pressure reading on the manometer and the same can be read on the vertical scale.
4. Simultaneously, using as top watch the time required for 2000cc of water to pass through the sand of specimen is also recorded.
5. Permeability number can be determined by the following relation;

$$\text{Permeability Number} = \frac{V \cdot H}{A.P.T.}$$

Where V = volume of air passed through the specimen H = height of the specimen

A = area of the specimen

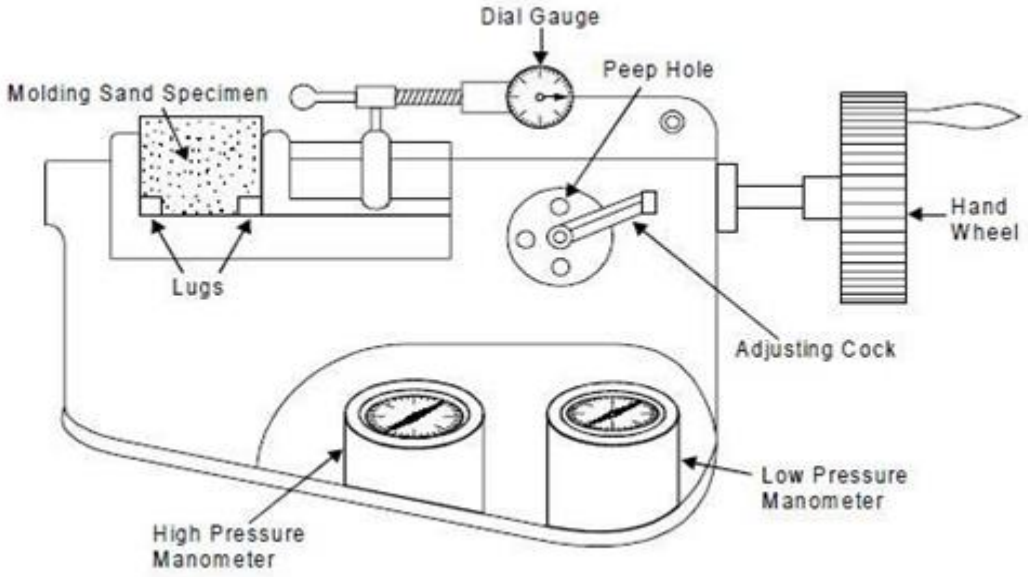
T = time taken by the air to pass through the sand specimen

P = pressure recorded by manometer.

COMPRESSION STRENGTH TEST:

1. The specimen is held between the grips.

2. Hand wheel when rotated actuates a mechanism which builds up hydraulic pressure on the specimen.
3. Dial indicator fitted on the tester measures the deformation occurring in the specimen.
4. As the applied load is continues, the specimen breaks at a particular load.
5. At this point note down the reading of dial indicator which directly gives the compression strength of the sand.



PRECAUTIONS:

1. For calculating grain size of sand, sand taken should be free from dirt particles.
2. For calculating the compression strength, load is applied gradually on the specimen.

RESULT:

OBSERVATION

14. TO STUDY OF 3D PRINTING

Introduction:-

3D printing allows for rapid prototyping and onsite manufacturing of products. Initially done with plastic, 3D printing now uses new techniques with new materials, such as aluminum, bronze, and glass. Biomaterials are also being incorporated, such as 3D printing ear cartilage and liver tissue. As the 3D printing industry grows, 3D printing will become a big part of many engineering fields Introduction:- 3D printing allows for rapid prototyping and onsite manufacturing of products. Initially done with plastic, 3D printing now uses new techniques with new materials, such as aluminum, bronze, and glass. Biomaterials are also being incorporated, such as 3D printing ear cartilage and liver tissue. As the 3D printing industry grows, 3D printing will become a big part of many engineering fields

components of 3D Printer: •

1. **axes**

   Fixed Rods The three axes that the 3D printer utilizes are on the Cartesian coordinate system. The linear fixed rods are maintained at right angles to each other and each represents a coordinate axis.

   Movement The timing belts and pulleys allow the movement of the hot end (or the print bed, depending on the type of 3D printer) along each axes according to the g-code (generated by slicing software). The stepper motors power this movement.

2. Extruder

   Extrusion is the feeding of filament into the hot end of the 3D printer. This movement is also powered by a stepper motor.

   Retraction This mechanism is the pulling of the melted filament from the hot end. This movement is primarily programmed through the g-code to prevent the formation of unwanted filament creating a bridge between two areas. The bridging of unwanted filament is referred to as stringing or the formation of cobwebs.

   Dual Extrusion Some models of 3D printers are equipped with dual extrusion capabilities. This allows for mixed material objects to be printed. Dual extrusion can used to print out complex objects with a different colour material as the support, making it easy to differentiate between the object and the support.

3. **Hot End**

   The hot end is heated to temperatures ranging from 160 C to 250 C, depending on the type of filament to be used. The hot end melts the filament and pushes the melted filament through the nozzle. The hot end needs to be thermally insulated from the other components of the 3D printer to prevent any damage.

4. Print Bed

Heated Print beds that are heated improve print quality of 3D printed objects. The heated bed is heated to the glass transition temperature of the filament being used. This allows the model layers to slightly melt and stick to the heated bed.

Non-Heated Print beds that are not heated require adhesion in the form of glue, tape, hairspray, etc. In the innovation lab, painters tape is frequently used for adhesion.

5. Filament

Filament is a consumable used by the 3D printer to print layers. Filament comes in a variety of materials and colors. Filament can be composed of metal, wood, clay, biomaterials, carbon fiber, etc.

i). **ABS**: - ABS is a thermoplastic that needs to be heated to temperatures from 210C to 250C. ABS can only be printed on a 3D printer with a heated bed, which prevents the cracking of the object. When ABS is heated, it emits a strong unpleasant odor. ABS requires a complete enclosure while printing.

ii). **PLA**: - PLA is a thermoplastic that needs to be heated to temperatures from 160C to 220C. PLA is also biodegradable and emits slight odors. PLA is most frequently used in the Innovation Lab on all 3D printers

PVA PVA is a water soluble plastic that is frequently used for support in dual extrusion 3D printers. The printed object is left in water where the PVA support is dissolved and the finished object printed in the other filament remains.

Preparing your 3D Model in CAD Software: •

CAD software is used to create 3D models and designs. This software is available on our computers and the level of difficulty varies. With the exception of Sketch up Pro and the industry standard software mentioned, all of these programs are available on the innovation lab computers.

Solid works main idea is user to create drawing directly in 3D or solid form. From this solid user can assemble it directly on their workstation checking clashes and functionality of it. Creating drawing is pretty easy just drag and drop the solid to drawing block.

Preparing your 3D Model for print in Idea maker software:-

These are following step for 3D printing of model

1. Install the 3D print software idea maker

2. Check repair option in this software
3. Set the nozzle parameter and build tack temperature according to the printer guide

Step:-1 Prepare the design Model using Designing Software(Solids Work,Autocad etc.)

Step:-2 Convert the designed Model file in Stl ,obj format.

Step:-3 Prepare the design model for printing Using Software Idea Maker and Ultimaker. Then set all parameter (nozzle temp., build task temp and support) and also repair your design using software option. Then after generate the file in geode format

Step:-4 ON the 3D Printer and load the filament in nozzle and give the command print by using 3D Printing Machine.

Precaution of 3D Printer machine: •

These are some following precaution when you print the design in 3D Printer

1. Mechanical: Do not place limbs inside the build area while the nozzle is in motion. The printer nozzle moves in order to create the object.
2. High Temperature: Do not touch the printer nozzle –it is heated to a high temperature in order to melt the build material.
3. Always buy replacement parts from the manufacturer for safety related equipment
4. Choose an area that has adequate ventilation and exhaust capability

Safety Equipment:•

Safety Glasses
Gloves (recommended for post processing

Applications of 3D Printer:

Automotive, Medical, Engineering, Customize parts, Less transport, Freedom for design.

OBSERVATION