INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

MANUFACTURING PROCESSES LABORATORY								
III Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AMED10	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes:45**				**Total Classes:45**		
Prerequisite: Manufacturing Practice								

I. COURSE OVERVIEW:
Manufacturing Processes laboratory is intended to enhance the learning experience of the students with new tools, equipment, and techniques for creating physical objects and mechanisms with a variety of materials. Skills learned in the course enable analogous learning about the design process in manufacturing used in various industrial applications and empowers the students to apply modern concepts of manufacturing technologies.

II. COURSES OBJECTIVES:
The students will try to learn

I. The Importance of manufacturing sciences in the day-to-day life, and study the basic manufacturing processes and tools used.
II. The knowledge in thermal, metallurgical aspects during casting and welding for defect free manufacturing components.
III. The design features that make each of this manufacturing process both harder, easier, assess design and manufacturing features on real products.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO 1 Identify the design steps involved in making a casting for automotive components.
CO 2 Demonstrate practical usage of Gas welding and Arc welding techniques for making Lap and Butt joints.
CO 3 Make use of different types of welding techniques for Industrial Applications.
CO 4 Analyze various defects during gas welding, arc welding process and their causes and remedies.
CO 5 Demonstrate working principle of various sheet metal forming process such as Hydraulic press, deep drawing and bending operation.
CO 6 Demonstrate the various process in making of plastic components for engineering / domestic applications.

IV. COURSE CONTENT:

EXERCISES ON MANUFACTURING PRACTICES

Note: All dimensions are in mm.

Safety
Safety is a vital issue in all workplaces. Before using any equipment and machines or attempt practical work in a workshop everyone must understand basic safety rules. These rules will help keep all safe in the workshop.

Safety Rules

1. Always listen carefully to the teacher and follow instructions.
2. When learning how to use a machine, listen very carefully to all the instructions given by the faculty / instructor. Ask questions, especially if you do not fully understand.
3. Always wear an apron as it will protect your clothes and holds lose clothing such as ties in place.
4. Wear good strong shoes.
5. Bags should not be brought into a workshop as people can trip over them.
6. Do not use a machine if you have not been shown how to operate it safely by the faculty / instructors
7. Know where the emergency stop buttons are positioned in the workshop. If you see an accident at the other side of the workshop you can use the emergency stop button to turn off all electrical power to machines.
8. Wherever required, wear protective equipment, such as goggles, safety glasses, masks, gloves, hair nets, etc.
9. Always be patient, never rush in the workshop.
10. Always use a guard when working on a machine.
11. Keep hands away from moving/rotating machinery.
12. Use hand tools carefully, keeping both hands behind the cutting edge.
13. Report any UNSAFE condition or acts to instructor.
14. Report any damage to machines/equipment as this could cause an accident.
15. Keep your work area clean.

Getting Started Exercises

Introduction to Manufacturing Process Laboratory

Manufacturing Process laboratory is the process of turning raw materials or parts into finished goods through the use of tools, human labour, machinery, and chemical processing. Most products were handmade using human labour and basic tools before the Industrial Revolution. This is normally accomplished by carrying out a set of activities such as product design, selection of raw material, and materials processing.

1. Principles of pattern design and making

A pattern is a mould forming tool in the hands of foundry men except for the various allowances a pattern exactly resembles the casting to be made. pattern may be defined as a model or form around which sand is packed to give rise to a cavity known as mould cavity in which when molten metal is poured result is CAST OBJECT.

1.1 Design and prepare a wooden pattern for the given casting with consideration of suitable allowances

Hint:

- A pattern prepares a mold cavity for the purpose of making a casting.
- A pattern may contain projections known as core prints if the casting requires a core and need to be hallow.

- Runner, gates and risers (used for introducing and feeding molten metal to the mold cavity) may form the part of the pattern.
- A pattern may help in establishing locating points on the mold and therefore on the casting with a purpose to check the casting dimensions in figure 1.1

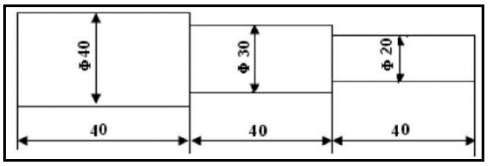


Figure 1.1. Stepped Pattern

1.2 Prepare a wooden pattern for the given casting

Pattern may be defined as a model or form around which sand is packed to give rise to a cavity known as mould cavity in which when molten metal is poured result is CAST OBJECT. From figure 1.2

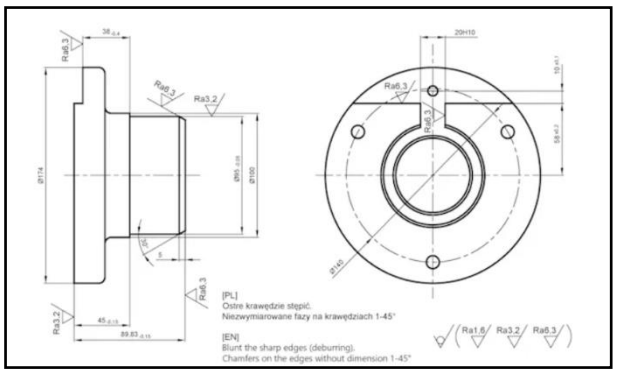


Figure 1.2. Flange Pattern

Try:

1. Design and analyze a wood pattern using computer-aided design (CAD) software and to simulate the casting process to ensure the pattern's accuracy and effectiveness.
2. Design a pattern for the casting which is to be made of steel by considering Shrinkage and Draft allowance as shown in the Figure 1.3.

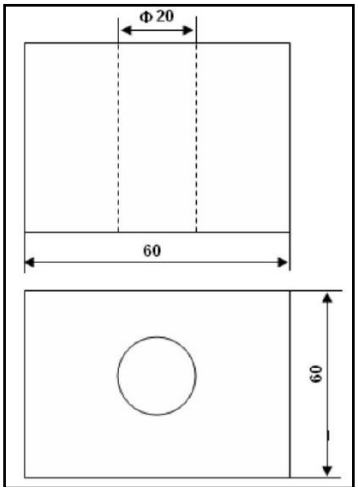


Figure 1.3. Spur gear

2. Casting using green sand moulding processes.

The principal material used in the foundry shop for moulding is the sand. This is because it possesses the properties vital for foundry purposes. Green Sand is a mixture of silica sand with 18 to 30 percent clay, having a total water of from 6 to 8 percent. The clay and water furnish the bond for green sand. It is fine, soft, light, and porous. Being damp, when squeezed in the hand, it retains the shape, the impression given to it under pressure. Moulds prepared in this sand are known as greensand moulds.

2.1 Preparation of an aluminium casting for the given split pattern using green sand moulding processes

Hint:

- To make the green-sand mould the sand must be properly tempered before it can be used. If the sand is too dry, additional water is added or if too wet, dry sand is added until it has the proper temper.
- The surface of the mould which comes in contact with molted metal forms the most important part in green-sand moulds. In order to give the casting a clean and bright surface and to prevent the sand from burning on the face of the mould a layer of facing sand is given surrounding the pattern as shown in Figure 2.1
- It is common practice to coat the surfaces of sand mould with refractory materiel to produce a smooth skin on the castings. The material ordinarily used for this purpose is graphite, coke, charcoal, gas carbon, etc.

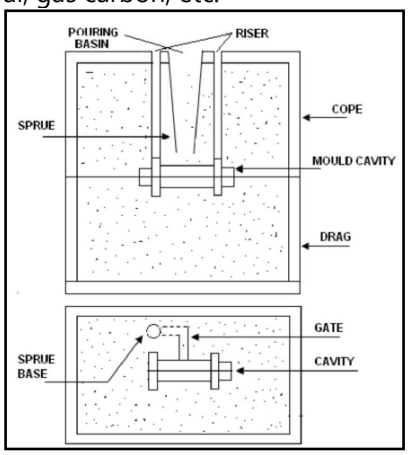


Figure 2.1. Mould for Split Pattern

2.2 Preparation of an aluminium casting for the given split pattern using green sand moulding processes

The surface of the mould which comes in contact with melted metal forms the most important part in green-sand moulds. In order to give the casting a clean and bright surface and to prevent the sand from burning on the face of the mould a layer of facing sand is given surrounding the pattern as shown in Figure 2.2

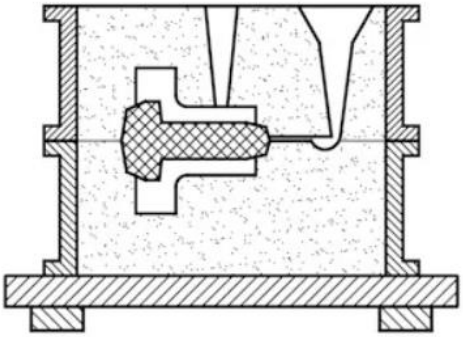


Figure 2.2. Mould for Split Pattern

Try:

1. Preparation of a cast iron casting for the given split pattern using green sand moulding processes.
2. To design and simulate different moulding processes using computer-aided design (CAD) and computer-aided engineering (CAE) software, with the goal of optimizing the mould design and improving the quality of the final product.

3. Introduction to Arc Welding

Arc welding is a welding process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals, when cool, result in a binding of the metals. It is a type of welding that uses a welding power supply to create an electric arc between a metal stick ("electrode") and the base material to melt the metals at the point of contact.

Types of Welding Joints: While designing for welding it appears both logical and fundamental to first consider the various forms of weld joints. A joint indicates the position where two or more members of a structure meet and are to be joined by welding. Classification:

i) Butt Joint
ii) Edge Joint
iii) Tee Joint
iv) Corner Joint
v) Lap Joint

3.1 Preparation of LAP JOINT using Arc Welding Process

Hint:

- Single fillet and double fillet joints shown in figure 3.1 are used on all thicknesses; double fillet
- joint is better as compared to single fillet when the joint is subjected to severe loading. Single
- fillet joints are not recommended on plates under bending, fatigue or impact loading conditions.

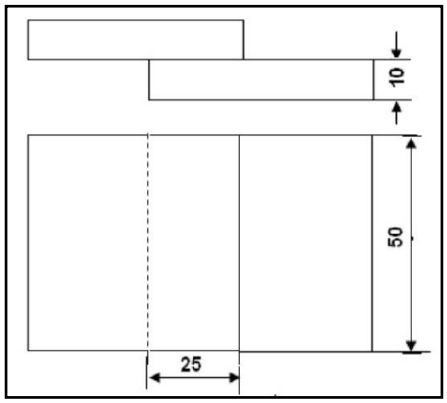


Figure 3.1. Lap Joint 1

3.2 Preparation of LAP JOINT using Arc Welding Process for different size

It is a type of welding that uses a welding power supply to create an electric arc between a metal stick ("electrode") and the base material to melt the metals at the point of contact as shown in the Figure 3.2

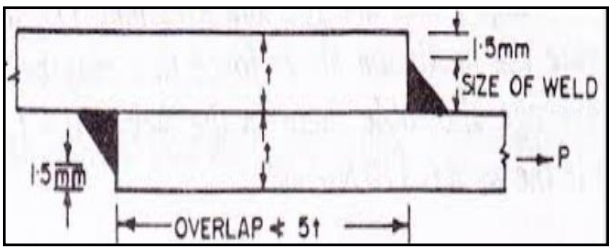


Figure 3.2. Lap Joint 2

Try

1. Preparation of BUTT JOINT using Arc Welding Process.
2. To simulate and analyze the arc welding process using computer-aided engineering (CAE) software, with the goal of optimizing welding parameters and ensuring the quality of the weld joint.

4. Introduction to Spot Welding

In resistance welding (RW) a low voltage (typically IV) and very high current (typically 15,000A) is passed through the joint for a very short time (typically 0.25 s). This high amperage heats the joint, due to the contact resistance of the joint and melts it. The pressure on the joint is continuously maintained and the metal fuses together under this pressure.

i) The resistance of the electrodes.
ii) The contact resistance between the electrode and the work piece.
iii) The contact resistance between the two work piece plates.
iv) The resistance of the work piece plates.

4.1 Preparation of Lap Joint on the given work pieces using spot welding equipment

Hint:

- The two pieces to be joined by spot welding are placed between the two electrodes in the required position.
- Set the timer for which the current flows through the electrodes with reference to the thickness of the plates.
- Press the foot lever, so that the movable electrode moves towards the fixed electrode.
- This causes to develop a pressure of about 200-1000 Kg / cm2 on the sheets for figure 4.1

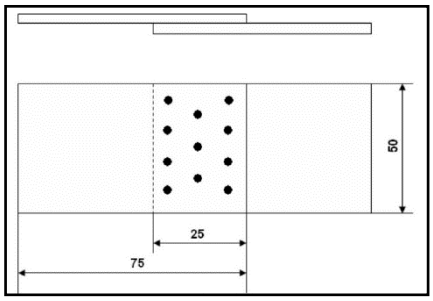


Figure 4.1. Spot Lap Joint 1

4.2 Preparation of Lap Joint on the given work pieces using spot welding

Set the timer for which the current flows through the electrodes with reference to the thickness of the plates figure 4.2

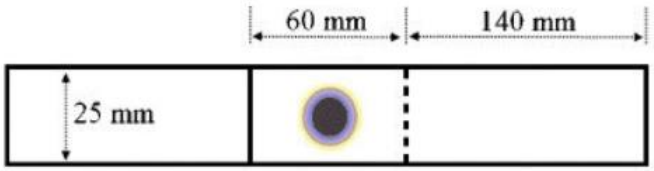


Figure 4.2. Spot Lap Joint 2

Try;

1. Preparation of Stainless steels joint.
2. To simulate and analyze the spot welding process using computer-aided engineering (CAE) software, with the aim of optimizing welding parameters, ensuring strong weld joints, and reducing defects such as expulsion and cracking.

5. Introduction to Tungsten Inert Gas (Tig) Welding

The Endeavour of welder is always to obtain a joint which is as strong as the base metal and at the same time, the joint is as homogeneous as possible. To this end, the complete exclusion of oxygen and other gases which interfere with the weld pool to the detriment of weld quality is very essential. In manual metal arc welding, the use of stick electrodes does this job to some extent but not fully. In inert gas shielded arc welding processes, a high-pressure inert gas flowing around the electrode while welding would physically displace all the atmospheric gases around the weld metal to fully protect it.

i) The shielding gases most used are argon, helium, carbon dioxide and mixtures of them.
ii) Argon and helium are completely inert and therefore they provide completely inert atmosphere around the puddle, when used at sufficient pressure. Any contaminations in these gases would decrease the weld quality.

5.1 Preparation of V – Butt Joint Using TIG Welding

Hint:

- Prepare the edges of the work pieces to be joined to the required V shape.
- Finish the edges using emery paper.
- Place the work pieces on the work table in the required position.
- Set the current of the machine to 100 A.
- Fix the tungsten electrode to the electrode holder.
- Required size of the nozzle is selected and it is fixed to the torch using figure 5.1

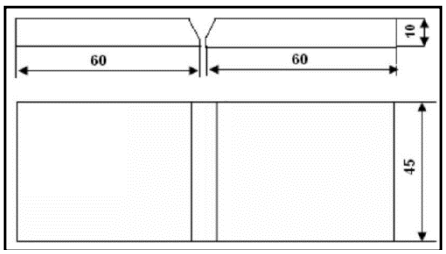


Figure 5.1. V Butt Joint 1

5.2 Preparation of V – Butt Joint Using TIG Welding

Argon and helium are completely inert and therefore they provide completely inert atmosphere around the puddle, when used at sufficient pressure. Any contaminations in these gases would decrease the weld quality using figure 5.2

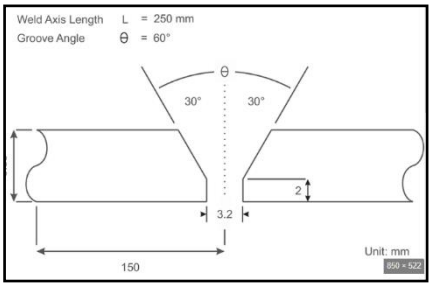


Figure 5.2. V Butt Joint 2

Try;

1. Preparation of Mild Steel (MS) T Joint using TIG welding
2. To simulate and analyze the TIG welding process using computer-aided engineering (CAE) software, with the goal of optimizing welding parameters, ensuring high-quality welds, and minimizing defects like porosity and thermal distortion.

6. Introduction to Sand Properties Testing

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.

i) Molten metal always contains a certain amount of dissolved gases, which are evolved when the metal freezes.

ii) 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.

6.1 Determination of the Grain size and Permeability of the Moulding Sand

Hint:

- 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.
- A sample of dry sand is placed in the upper most sieve and place the sieve stand on the vibrator.
- Then vibrate the sieve stand for a definite period.
- An amount of sand may be retained on each sieve and same is weighed.
- Calculate the AFS grain fineness number using figure 6.1

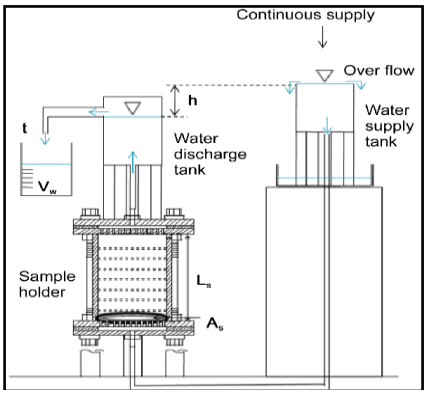


Figure 6.1. Grain Size and Permeability Tester

6.2 Determination of the Strength and Permeability of the Moulding Sand

- A sample of dry sand is placed in the upper most sieve and place the sieve stand on the vibrator. Then vibrate the sieve stand for a definite period. An amount of sand may be retained on each sieve and same is weighed. Calculate the AFS grain fineness number figure 6.2.

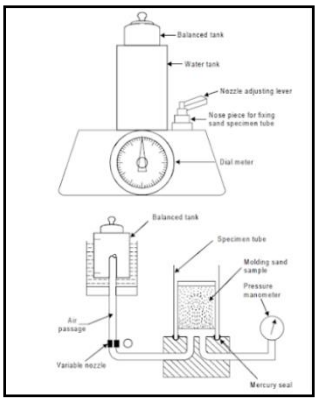


Figure 6.2. Strength and Permeability Tester

Try:

1. Determination of the Compressive Strength of the Moulding Sand.
2. To simulate and analyze the properties of foundry sand using software, focusing on key characteristics such as grain size distribution, permeability, compaction, and thermal stability, with the aim of optimizing the sand for casting applications.

7. Introduction to Casting for a Solid Pattern

The principal material used in the foundry shop for moulding is the sand. This is because it possesses the properties vital for foundry purposes. Sources: All sands are formed by the breaking up of rocks due to the action of natural sources such as frost, wind, rain, heat and water currents. Rocks however are very complex in their composition and sands contain most of the elements of the rocks of which they fragment. For this reason, sands in different parts of the world vary considerably. Today, sand is obtained from places which probably once were bottoms and banks of rivers and sand dunes.

i) Silica in the form of granular quartz, itself sand is the chief constituent of moulding sand.
ii) Silica sand contains from 80 to 90 percent silicon dioxide and is characterized by a high softening temperature and decomposition of granite, which is composed of feldspar and quartz.
iii) The feldspar, when decomposed, becomes clay (hydrous aluminium silicate). However, silica sand grains impart refractoriness, chemical resistivity, and permeability to the sand. They are specified according to their average size and shape.

7.1 Preparation of a Casting for the given Solid Pattern using Green Sand Moulding Processes

Hint:

- First the pattern is placed with its larger diameter side is on a mould board.
- The drag section of the flask is set over the pattern on same board.
- After powdering the pattern with lycopodium, talc or graphite, a 15 to 20 mm layer of facing sand is riddled over the pattern.
- The drag is then filled by layers of green sand mixture from 70 to 100 mm thick, compacting each layer with rammer.
- The top of the mould is rammed with the butt end of a rammer. The object of ramming the sand is to consolidate using figure 7.1

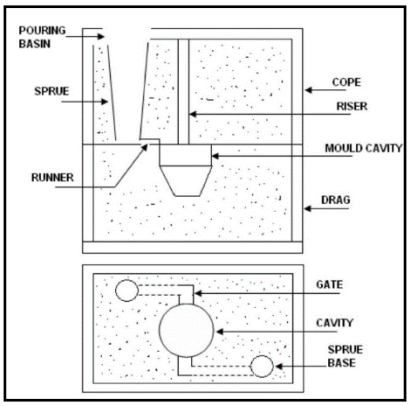


Figure 7.1. Sectional View of Green Sand Mould

7.2 Preparation of a Casting for the given Solid Pattern using Green Sand Moulding Processes

After powdering the pattern with lycopodium, talc or graphite, a 15 to 20 mm layer of facing sand is riddled over the pattern. The drag is then filled by layers of green sand mixture from 70 to 100 mm thick, compacting each layer with rammer. The top of the mould is rammed with the butt end of a rammer. The object of ramming the sand is to consolidate figure 7.2.

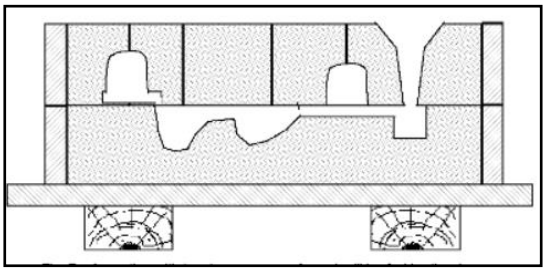


Figure 7.2. Casting of Green Sand Mould

Try;

1. Perform the Casting for the given Aluminium Solid Pattern using Green Sand Moulding Processes.
2. To design and develop a solid pattern using CAD software, with the aim of creating a precise and detailed 3D model that can be used for manufacturing processes such as casting or CNC machining.

8. Introduction to Simple Die

A shaping machine is a mechanical device used to shape and form metal workpieces. It operates by removing material through a reciprocating cutting motion, resulting in the desired shape or contour. Shaping machines are commonly used in metalworking industries for various applications, including creating flat surfaces, slots, and grooves.

i) A rigid table on the machine supports the workpiece. Over the workpiece, the ram moves back and forth as shown in the animation above. A vertical tool slide is adjusted to either side of the vertical plane along the stroke axis, which is located at the front of the ram.

ii) The geometry of the linkage causes the ram to travel more quickly on the return stroke than the forward stroke (cutting stroke). As the shaper works on the quick return mechanism, the sliding action of the slider is aided by the rotating link.

iii) One of the four mechanisms i.e. crank and slotted, whitworth quick return, hydraulic, and automatic table feed mechanism, is responsible for the quick return mechanism and

reciprocating movement of the ram. The automatic table feed is commonly used today which employs a pawl and ratchet mechanism in a shaping machine.

8.1 Preparation of V-groove operation

Hint:

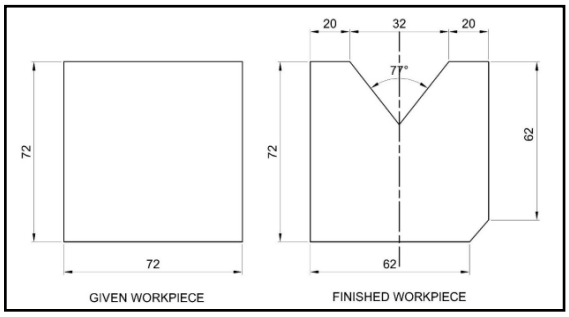
- The job is fixed on a vice and the tool is fixed on tool post.
- The stroke of ram is adjusted to required length and machine is switched on.
- Always during machining, the job should be properly fixed with the half of try Square and vice to get a right-angle surface after machining.
- After completion of work, the job should be filled help of file before fixing the job, V block dimensions are marked on the job with the help of dot punch.
- The tool head should be rotated at 450 to make the V- groove.
- The feed is given such that the tool moves gradually on either side of the middle line for figure 8.1
- 

Figure 8.1. V-groove operation

8.2 Preparation of Straight groove operation

Always during machining, the job should be properly fixed with the half of try Square and vice to get a right-angle surface after machining. After completion of work, the job should be filled help of file before fixing the job, V block dimensions are marked on the job with the help of dot punch from figure 8.2.

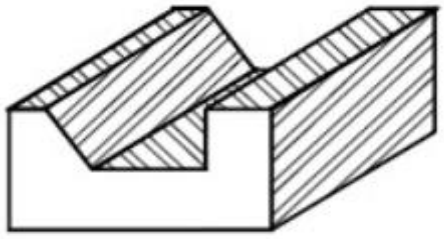


Figure 8.2. Stright groove operation

Try;

1. Perform the key ways on a cylindrical work piece to obtain the required dimensions using shaping machine.
2. Create an initial 2D sketch of the part to be formed, detailing key dimensions, tolerances, and any specific features like holes or bends.

9. Introduction to Progressive Die

Press working may be defined as a chip less manufacturing process by which various components are made from sheet metal. This process is also termed as cold stamping. A frame which supports a ram or

a slide and a bed, a source of mechanism for operating the ram in line with and normal to the bed. The ram is equipped with suitable punch and a die block is attached to the bed. A stamping is produced by the down ward stroke of the ram when the punch moves towards and into the die block. The punch and die block assembly is generally termed as a"die set" or simply as a "die". Press working operations are usually done at room temperature.

i) Before starting any installation work, the first and foremost thing is the concern of safety of the personnel. Electricity is dangerous and direct or indirect contact of electrical equipment or wires with the power turned ON can result in serious injuries or sometimes even causes death. Follow the below steps to maintain the safety at the workplace.

ii) Several factors must be considered before the actual installation work to be done for residential, commercial, or industrial wiring. These factors include type of building construction, type of ceiling, wall, and floor construction, wiring methods, installation requirements, etc.

9.1 To perform blanking and piercing operations and determine the punching force and blanking force theoretically

Hint:

- A progressive or follow on die has a series of stations. At each station an operation is performed on the work piece during a stroke of the press.
- Between strokes the piece in the metal strip is transferred to the next station. A finished work piece is made at each stroke of the press.
- A progressive die is shown in figure 9.1 while the piercing punch blanks out a portion of the metal in which two holes had been pierced at a previous station Thus after the stroke two holes will be punched each stroke of the press produces a required finished component using figure 9.1

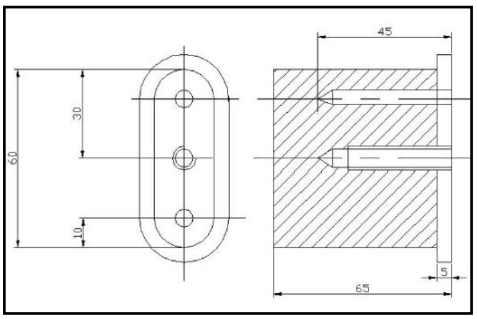


Figure 9.1. Progressive Die

9.2 To perform blanking and piercing operations and determine the punching force and blanking force theoretically

- A progressive die is shown in figure 9.2 while the piercing punch blanks out a portion of the metal in which two holes had been pierced at a previous station Thus after the stroke two holes will be punched each stroke of the press produces a required finished component using figure 9.2

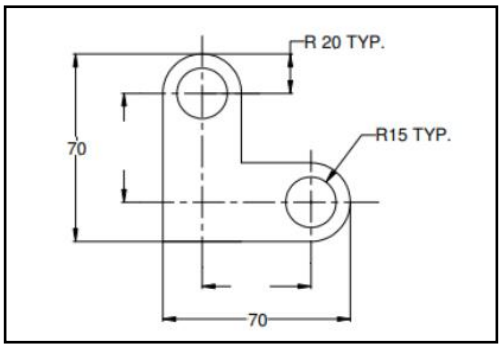


Figure 9.2. Progressive holed Die

Try;

1. Prepare blanking and piercing operations on different materials.
2. To design a progressive die using CAD software, focusing on creating a series of operations that transform a metal strip into a finished part, with multiple stages in a single die.

10. Introduction to Compound Die

A Compound Die is employed when multiple cutting operations are conducted in a single stroke at one stage. This die type offers certain advantages and limitations. Advantages of Compound Dies: High production rate since one component is produced per stroke.

i) Press working may be defined as a chip less manufacturing process by which various components are made from sheet metal.
ii) This process is also termed as cold stamping. A frame which supports a ram or a slide and a bed, a source of mechanism for operating the ram in line with and normal to the bed.
iii) The punch and die block assembly is generally termed as a "die set" or simply as a "die". Press working operations are usually done at room temperature.

10.1 To study a Compound tool and perform blanking and piercing operations

Hint:

- Fix the punch to the ram of the press.
- Fix the die on the bed of the machine using clamps, bolts and nuts.
- Place the blank of required size between the die and punch.
- Apply pressure hydraulically on the blank through the punch so that piercing will takes place at the first station.
- Note down the reading of the pressure gauge which directly gives the force required to perform the piercing operation figure 10.1

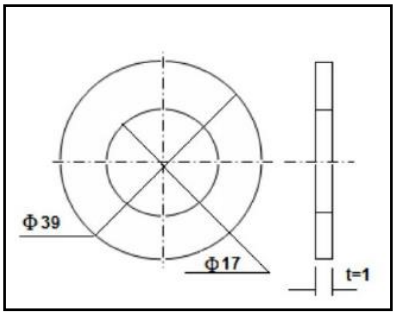


Figure 10.1. Blanking and Piercing operation 1

10.2 To study a Compound tool and perform blanking and piercing operations

Apply pressure hydraulically on the blank through the punch so that piercing will takes place at the first station. Note down the reading of the pressure gauge which directly gives the force required to perform the piercing operation figure 10.2

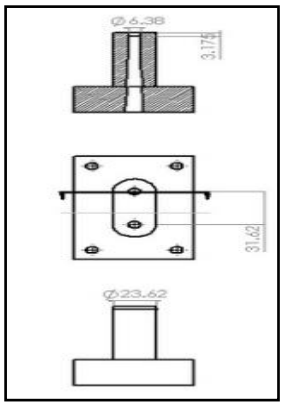


Figure 10.2. Blanking and Piercing operation 2

Try;

1. To determine the punching force and blanking force theoretically and compare the same with obtained readings.
2. To design and simulate blanking and piercing tools using CAD software, ensuring the precise cutting and hole-making operations in sheet metal.

11. Introduction to Injection Moulding

Polymers can be divided into three broad divisions: plastic
s, fibers and elastomers (polymers of high elasticity, for example, rubber). Synthetic resins are usually referred to as plastics. Plastics derive their name from the fact that in a certain phase of their manufacture they are present in a plastic stage (that is acquire plasticity), which makes it possible to impart any desired shape to the product. Plastics fall into a category known chemically as high polymers.

11.1 Perform injection moulding operation for given plastic raw material

Hints:

- Usually, a ceiling fan and table fan consist of a capacitor start and run motor. Capacitor are always connected in the circuit the advantages of leaving the capacitor permanently in circuit.
- It has one starting winding in series with one capacitor and running winding since the capacitor remains in the circuit permanently. This motor is often referred to as permanent. Split capacitor runs motor and behaves practically like an unbalanced 2phase motor from figure 11.1

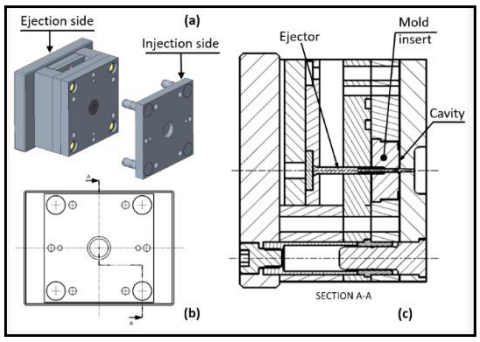


Figure 11.1. Injection moulding 1

11.2 Perform injection moulding operation for given plastic raw material

- Usually, a ceiling fan and table fan consist of a capacitor start and run motor. Capacitor are always connected in the circuit the advantages of leaving the capacitor permanently in circuit. It has one starting winding in series with one capacitor and running winding since the capacitor remains in the circuit permanently. This motor is often referred to as permanent. Split capacitor runs motor and behaves practically like an unbalanced 2phase motor from figure 11.2

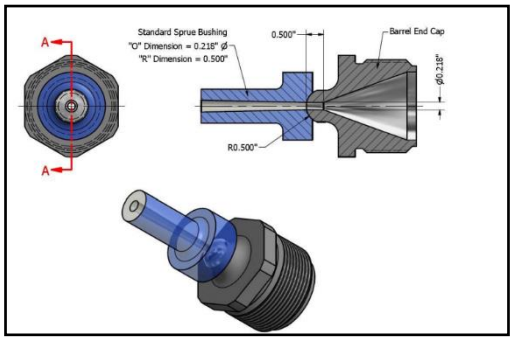


Figure 11.2. Injection moulding 1

Try;

1. Perform the Moulding for mixer grinder from a circuit board.
2. To design and simulate an injection mold using CAD software, ensuring that the mold will produce high-quality parts efficiently and reliably.

12. Introduction to Brazing

- The brazing process involves joining two pieces of metal together with the help of an alloy of non-ferrous nature that has been introduced in its liquid state. After applying the liquid nonferrous alloy, it is kept aside to allow cooling and solidifying. The alloy that is used to join the two pieces of metal, processes a melting point of 600°c. The alloy is therefore melted at this temperature but the two metal pieces which are being joined have a higher melting point. The metal that is used as a filler spread due to capillary action. The process of brazing is quite similar to soldering. However, soldering does not give a stronger joint than brazing. The basic difference between the process of brazing and soldering is the usage of a stronger filler material that is also known as a speller. The speller joins at a specific temperature that is lower than the red heat, and thus it nuts below the melting point of the two pieces of metal that are needed to be joined.

12.1 Preparation of joint using two sheets by brazing process

Hint:

- The surface to be joined is cleaned properly.
- Sheets are joined and laid by giving proper clearance.
- Flux is applied to the joint.
- 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.
- The filler material is flown into the service by capillary action and joint is made as in figure 12.1

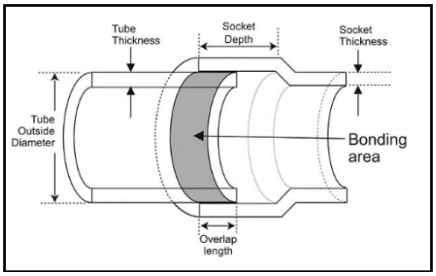


Figure 12.1. Brazing of flange

12.2 Preparation of joint using two sheets by brazing process

The surface to be joined is cleaned properly. Sheets are joined and laid by giving proper clearance. Flux is applied to the joint. 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. The filler material is flown into the service by capillary action and joint is made as in figure 12.2

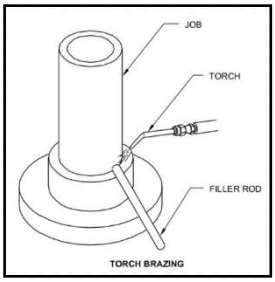


Figure 12.2. Brazing of flange of round cylinder

Try;

1. Perform the brazing operation on horizontal block.
2. To design and simulate a brazing process using software, ensuring the quality and effectiveness of the brazed joint.

13. Introduction to Hand Press

A hand press is a manual machine used to compress materials, often employed in printing or bookbinding to create uniform pages and covers. Its lever mechanism applies pressure to achieve precision and craftsmanship in each task. Intrigued by the tactile art of hand-pressed creations? Discover how this timeless tool continues to leave its mark in a digital world.

13.1 Prepare a required shape and Size of material using Hand press

Hint:

- 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 figure 13.1

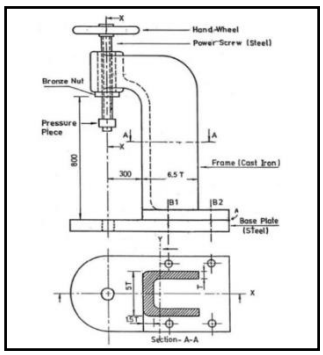


Figure 13.1. Hand press

13.2 Prepare a required shape and Size of different material using Hand press

In a vertical mechanical press machine, the force vector works upward and downward relative to gravity. In other cases, the same machine type is mounted horizontally where the working force is applied to the path perpendicular to the direction of the gravity. The working principle of the mechanical press is however the same no matter that the force is exerted vertically, horizontally, or at the intermediate angle using figure 13.2

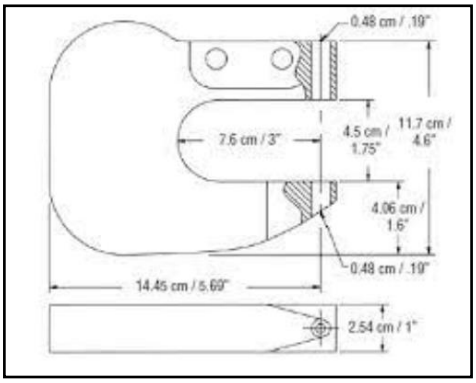


Figure 13.2. Hand press with dimensions

Try;

1. Perform the blank and watcher operation on fly press.
2. To design a hand press with precise dimensions using CAD software, ensuring it meets the required specifications for functionality and safety.

14. Introduction to Hydraulic Press

A hydraulic press is a mechanical device that uses the static pressure of a liquid, as defined by Pascal's principle, to shape, deform, and configure various types of metals, plastics, rubber, and wood. The mechanism of a hydraulic press consists of a mainframe, power system, and controls. Pascal's principle states that when pressure is applied to a confined liquid, a pressure change occurs in the liquid. For a hydraulic press, the pressure in a liquid is applied by a piston that works like a pump to create mechanical force.

14.1 Prepare a required shape and Size of material using Hydraulic Press

Hint:

- Set the compound die or progressive die or deep drawing die in the required position.
- Switch on the motor to start the machine.
- Pass the MS sheet in to the progressive die/compound die. In case of deep drawing
- Apply injection pressure using direction control valve.
- The plunger punches the sheet into the mosquito coil stand/washer lid shape.
- Release injection pressure as seen in figure 14.1
- Take out the finished product from the die.
- Switch off the motor

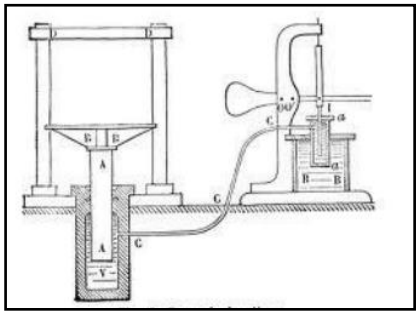


Figure 14.1. Hydraulic press

14.2 Prepare a required shape and Size of different material using Hydraulic Press

Set the compound die or progressive die or deep drawing die in the required position. Switch on the motor to start the machine. Pass the MS sheet in to the progressive die/compound die. In case of deep drawing. Apply injection pressure using direction control valve. The plunger punches the sheet into the mosquito coil stand/washer lid shape from figure 14.2

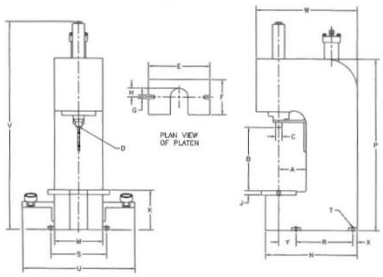


Figure 14.2. Hydraulic press using different materials

Try;

1. Perform the blank and pressing operation on hydraulic press.
2. To design a hydraulic press with accurate dimensions and functionality using CAD software, and to simulate its hydraulic system for performance and safety analysis

V. TEXT BOOKS:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and NirjharRoy S.K., *Elements of Workshop Technology*, Media promoters and publishers private limited, Mumbai, 2020.
2. Kalpakjian S, Steven S. Schmid, *Manufacturing Engineering and Technology*, Pearson Education India Edition, 7th Edition, 2019.

VI. REFERENCE BOOKS:

1. Gowri P. Hariharan, A. Suresh Babu, *Manufacturing Technology – I*, Pearson Education, 2018.
2. Roy A. Lindberg, *Processes and Materials of Manufacture,* Prentice Hall India, 4th Edition, 2017.
3. P.N., *Manufacturing Technology*, Vol. I and Vol. II, Tata McGraw-Hill House, 2017.
4. Rupinder Singh, J. Paulo Davim, *Additive Manufacturing: Applications and Innovations*, CRC Press, 2nd Edition, August, 2021.

5. Jeyaprakash Natarajan, Muralimohan Cheepu, Che-Hua Yang, *Advances in Additive Manufacturing Processes*, Bentham Books, 4th Edition, September, 2021.

VII. ELECTRONICS RESOURCES:

1. https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/additive-manufacturing-technologies-for-practicing-engineers/.
2. https://akanksha.iare.ac.in/index?route=course/details&course_id=94.

VIII. MATERIALS ONLINE:

1. Course Template
2. Lab manual