



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad – 500043

COURSE CONTENT

AIRCRAFT PRODUCTION TECHNOLOGY LABORATORY								
IV Semester: AE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
AAEC13	CORE	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			
Prerequisite: Mechanics of Solids								

I. COURSE OVERVIEW:

The Aircraft Production Technology Lab course provides hands-on experience with various manufacturing processes essential for aircraft production. Students will gain practical skills in basic metallurgy, machining operations, welding processes, casting, and other essential techniques involved in aircraft manufacturing. Each experiment is designed to equip students with the knowledge and skills necessary to excel in the aerospace manufacturing industry.

II. COURSES OBJECTIVES:

The students will try to learn:

- I. The fundamentals of metallurgy and its application in aircraft manufacturing.
- II. The proficiency in operating lathe machines for machining aircraft components.
- III. Skills in shaping, slotting, milling, grinding, and drilling techniques relevant to aircraft production.
- IV. Diverse welding processes and their applications in joining aircraft materials.
- V. The basics of casting and its significance in aircraft part manufacturing.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- CO1 Demonstrate the preparation and exploring microstructures in metals to grasp the impact of composition, processing, and heat treatment on material properties
- CO2 Utilize lathe machine technology to conduct turning operations on various materials, resulting in the fabrication of precise components
- CO3 Identify the machining processes necessary to produce the desired shapes of components used in aerospace and related industries
- CO4 Choose appropriate tools and process parameters for milling, drilling, shaping and slotting operations to produce components with minimal cost.
- CO5 Make use of various welding techniques for joining materials in real-world scenarios.
- CO6 Showcase molding processes and their practical application in manufacturing machine for components industrial use.

EXERCISES FOR AIRCRAFT PRODUCTION TECHNOLOGY LABORATORY

1. Getting Started Exercises

1.1 Introduction to Aircraft Production Technology Laboratory

- Understand the working principle of microscope, lathe and milling machines used in the laboratory.
- Become familiar with grinding, shaping, slotting and drilling machines.
- Learn to take quality control measures to ensure precision and accuracy in aircraft component fabrication.

Try

1. Prepare the aluminum sample for evaluation of microstructures
2. Plain turning operation on lathe machine for a given sample

2. Exercises on Basic Metallurgy -I

2.1 Microstructure of pure materials

Observe the micro structural features using the microscope for Mild steel Specimen shown in Figure 1.



Figure 1. Microscope

Try

1. Change the specimen to Aluminum with different surface finish and repeat the same experiment
2. Change the sample to Mild Steel with different surface finish and repeat the same experiment
3. Perform the experiment on Copper with different surface finish and repeat the same experiment

3. Exercises on Basic Metallurgy -II

3.1 Microstructure of non-ferrous alloys

Find the Micro structural Properties of the materials like weight, strength, toughness, hardness, corrosion, fatigue resistance, performance in temperature extremes using the microscope as shown in Figure 2.

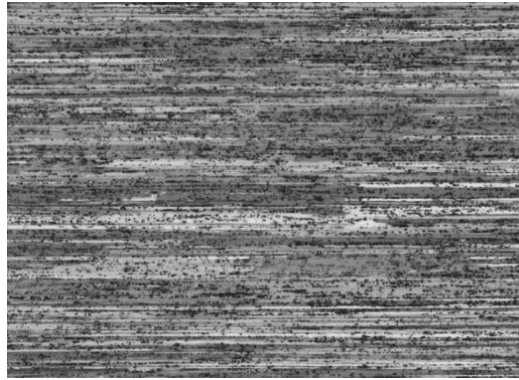


Figure 2. Microscopic view of MS plate

Try

1. Change the specimen to mild steel and find the above properties.
2. Perform the experiment on Aluminum and find the above properties.
3. Change the specimen to Steel and find the above properties.

4. Exercises on Lathe Operations – I

4.1 Plane turning, Step turning and Grooving

For the given work piece (mild steel) conduct the plain turning operation using the lathe Machine as shown in Figure 3.

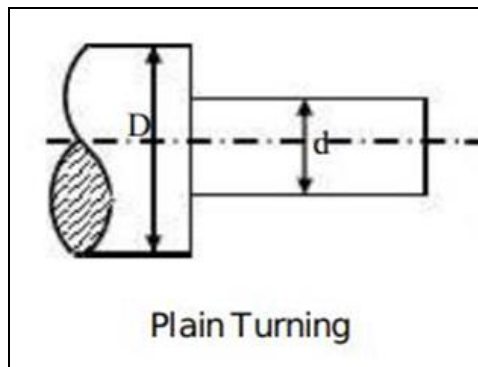


Figure 3. Plain Turning

4.2 Step turning and Grooving

For the given work piece (mild steel) conduct the step turning operation using the lathe Machine as shown in Figure 4.

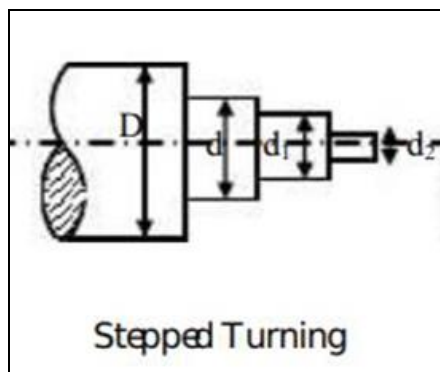


Figure 4. Stepped Turning

Try

1. Perform the Grooving operation for the Mild Steel (MS) Specimen.
2. Change the Specimen to steel the conduct the process.
3. Perform the step turning & grooving operation on Cast Iron Specimen.

5. Exercises on Lathe Operations – II

5.1 Taper turning-compound rest/offset method

Perform the Taper turning Operation for the given Specimen Mild Steel, using the Lathe Machine as shown in Figure 5.

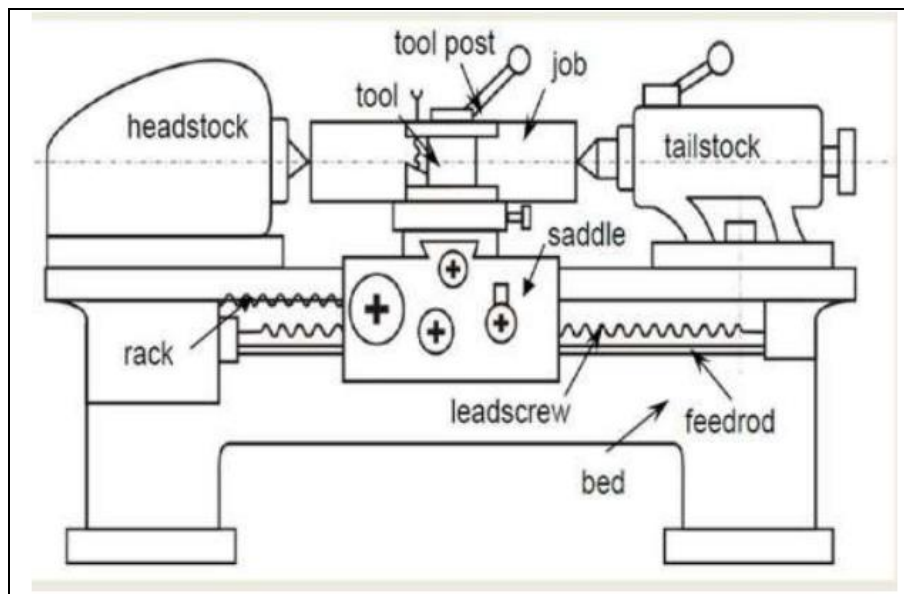


Figure 5. Lathe Machine

5.2 Drilling using lathe, External threading-Single start

Perform the drilling Operation On the Mild Steel work piece using lathe machine as shown in the figure 6.

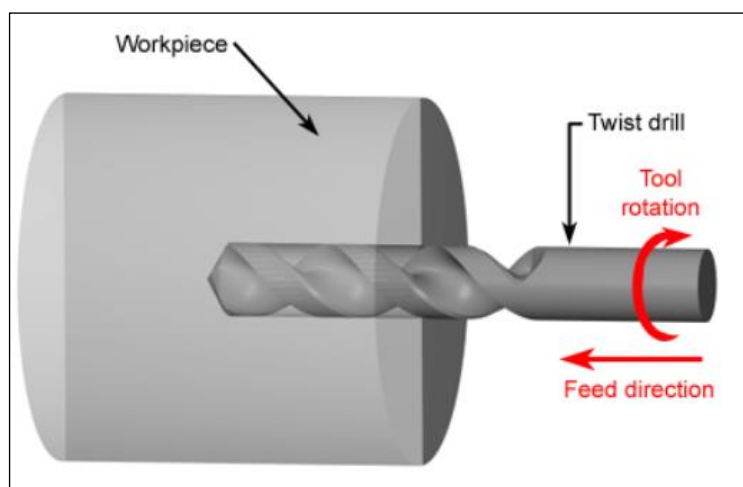


Figure 6. Drill bit & work piece

5.3 External threading-Single start

Perform the external threading operation on the mild steel work piece as shown in Figure 7.

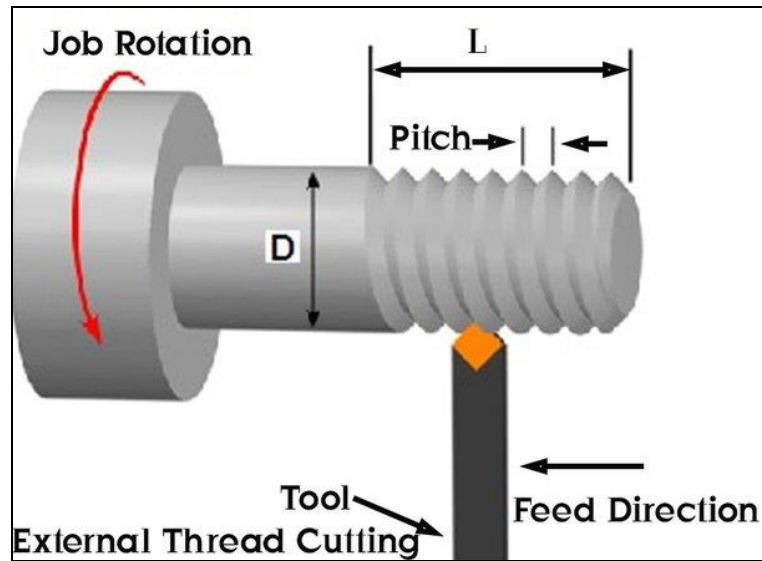


Figure 7. External Threading Operation by lathe

Try

1. Change the material to steel rod and perform the same operations.
2. Change the material to copper alloy and perform the threading operation.

6. Exercises on Shaping Machine

6.1 Shaping-V-Block

Using the Shaping Machine, perform the V- Shaped groove on Mild Steel as shown in Figure 8.

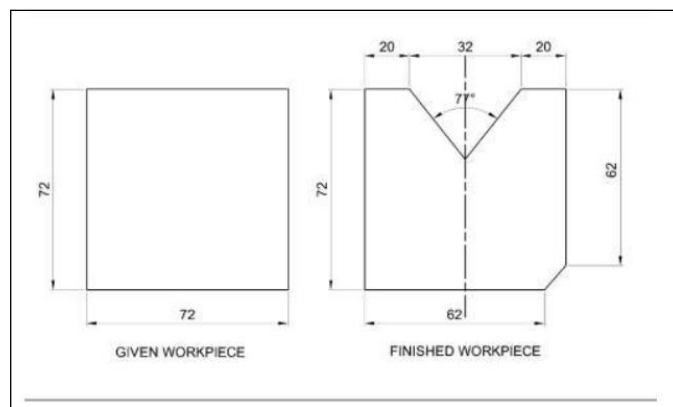


Figure 8. V-block shaping

Try

1. Change the Block to T Shape and perform the same operation on Mild Steel.
2. Perform the U shaped operation on the Mild steel work piece.
3. Change the tool bit to I Shape and perform the same operation on Mild Steel.

7. Exercises on Slotting Machine

7.1 Slotting-Keyways

Perform the Slotting Operation on the Mild Steel Specimen and obtain the required groove as shown in Figure 9.

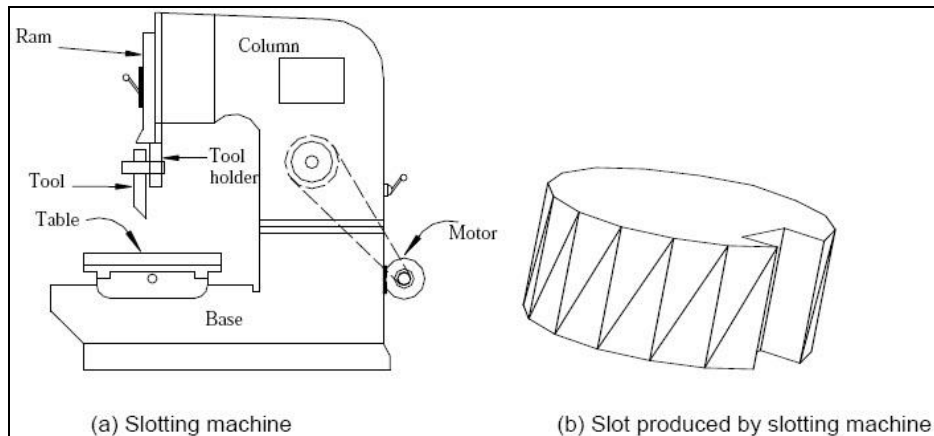


Figure 9. Figure 9. slotting machine & slot on work piece

Try

1. Slot the Cast Iron work piece and perform the same experiment.
2. Perform the Slotting Operation on the galvanized iron work piece and conduct the experiment.
3. Change the specimen to Steel with different surface finish and repeat the same experiment.

8. Exercises on Milling Machine

8.1 Milling-Face milling, End milling and Side milling

Perform the Face Milling Operation using the milling machine as shown in Figure 10, on the mild steel work piece as shown in Figure 11.

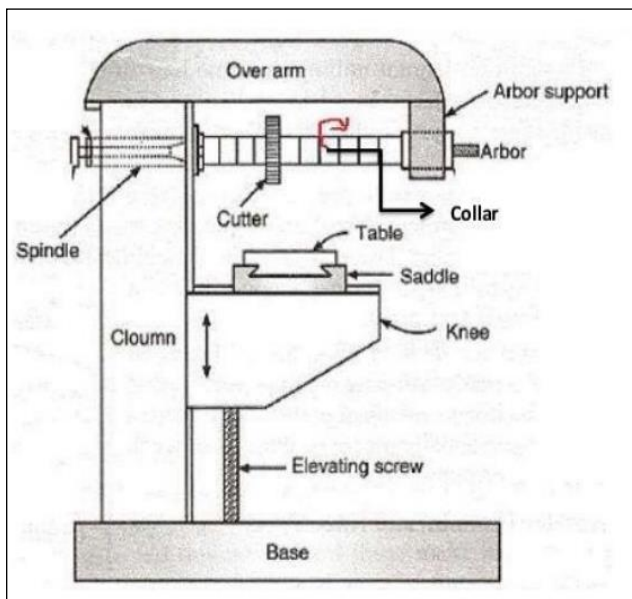


Figure 10. Milling Machine

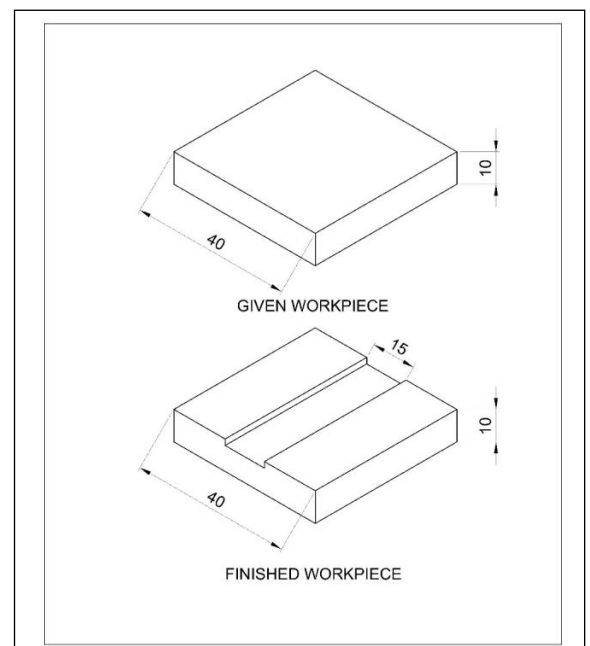


Figure 11. Work Piece Performed

8.2 End milling and Side milling

Perform the End milling operation on given work piece using milling machine as shown in the Figure 12.

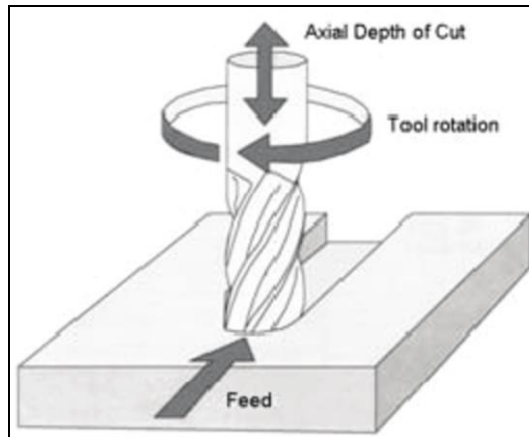


Figure 12. End Milling Performed

8.3 Side milling

Perform the side milling operation on the given work piece using the milling machine as shown in Figure 13.

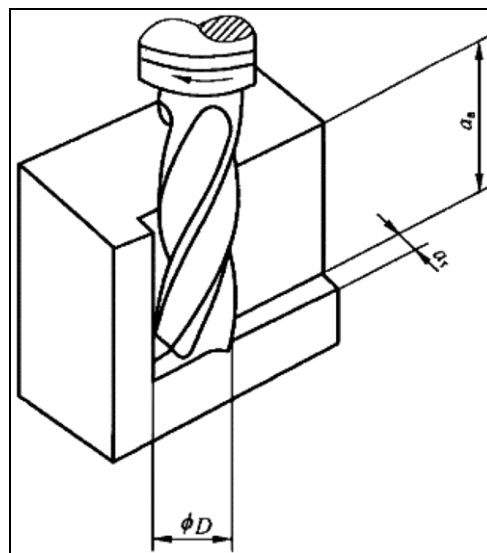


Figure 13. Side Milling Performed

Try

1. Change the Specimen to steel and perform the same experiment.
2. Perform the end milling operation on the galvanized iron specimen.

9. Exercises on Grinding Machine

9.1 Grinding-Cylindrical /Surface/Tool & cutter.

Perform the Grinding Operation using grinding machine as shown in Figure 14, for the Mild Steel Specimen and Remove the surface by 1 mm only as shown in the figure 15.



Figure 14. Grinding Machine

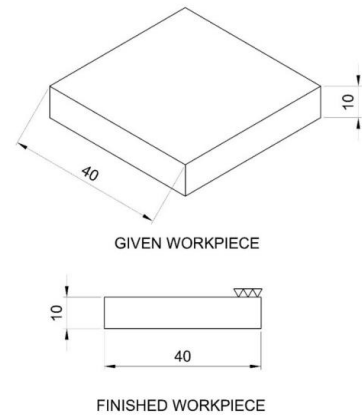


Figure 15. Workpiece

Try

1. Grind the surface of Cast Iron and perform the same experiment.
2. Grind the surface of Galvanized Iron and repeat the same experiment.
3. Smoothen the surface of steel and redo the same experiment.

10. Exercises on Drilling Machine

10.1 Drilling, reaming, counter boring, counter sinking and Taping.

Perform the Drilling & Reaming Operation on the Mild Steel Work Piece as shown in the Figure 16.

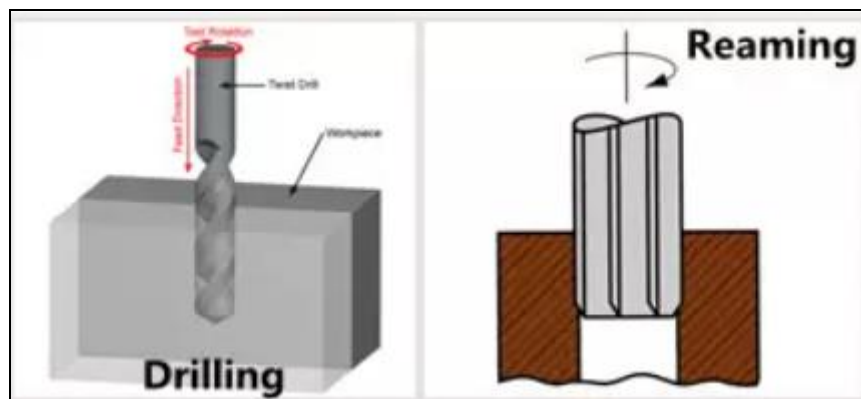


Figure 16. Drilling and Reaming

10.2 Counter boring, Counter sinking

Perform the counter boring and counter sinking operation on the given specimen using the drilling machine as shown in the figure 17.

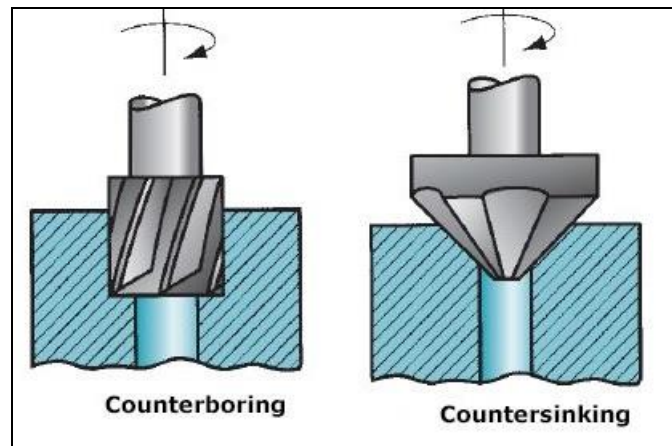


Figure 17. Counter Boring and Counter Sinking

Try

1. Perform the tapping operation in the mild steel specimen using the drilling machine.
2. Perform this reaming and counter boring operation on steel using the drilling machine.
3. Perform the counter sinking operation in the mild steel using drilling machine.

11. Exercises on Welding Process-I

11.1 Gas Welding, Brazing and Soldering.

Perform the Joining of two Mild steel Metal pieces in Butt Joint using Gas welding as shown in figure 19.

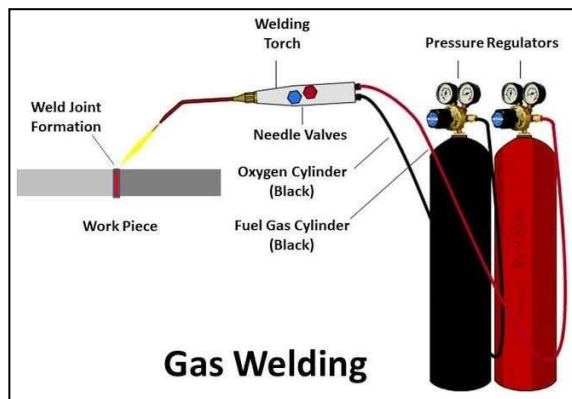


Figure 18. Gas Welding

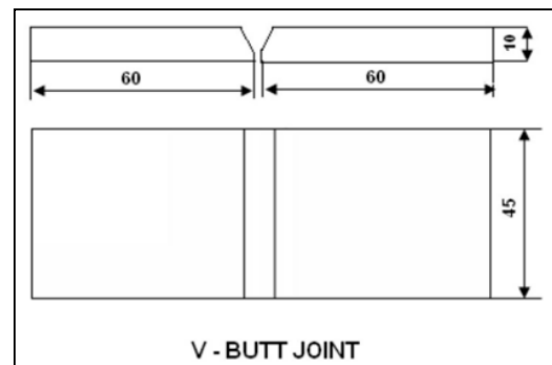


Figure 19 V- Butt Joint

11.2 Brazing and Soldering.

Perform the Joining of two Mild steel Metal pieces in Butt Joint using brazing operation as shown in Figure 20.

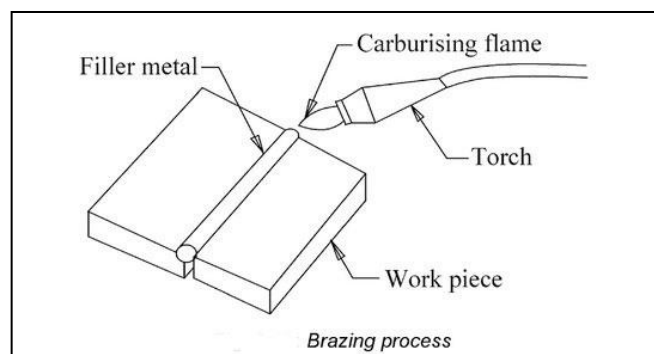


Figure 20. Brazing Operation

11.3 Soldering.

Perform the Joining of two Mild steel Metal pieces in Butt Joint using soldering operation as shown in Figure 21.

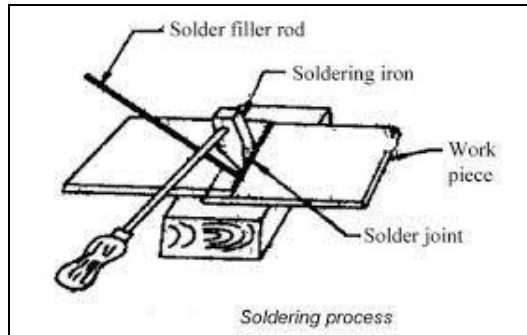


Figure 21. Soldering Process

Try

1. Perform the joining process in steel sheets using the brazing operation.
2. Perform the joining process in the galvanized iron using the gas welding process.
3. Perform the joining process in the copper alloy using the gas welding & brazing process.

12. Exercises on Welding Process-II

12.1 Arc welding and Spot welding

Perform the Joining of two Mild Steel Work pieces using the Arc welding as shown in Figure 22.

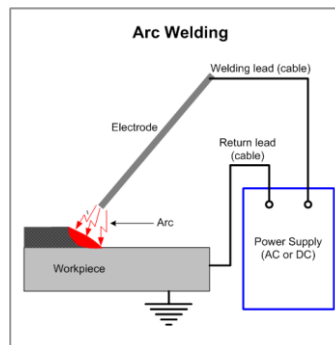


Figure 22. ARC Welding

12.2 Spot welding

Perform the Joining of two Mild Steel Work pieces using the Spot Welding as shown in Figure 23.

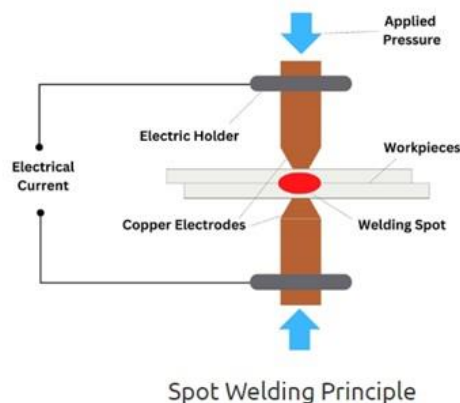


Figure 23. Spot Welding Principle

Try

1. Perform the Spot welding Operation using fixed length and find the strength.
2. Perform the Spot welding Operation Using Variable spot welding length and find the strength.
3. Perform the ARC welding operation with aluminum & riveting joint.

13. Exercises on Basic Casting

13.1 Preparation of casting with simple patterns.

Create a new solid rod with 50 mm length and 10 mm radius from the mold using the casting operation as shown in Figure 24.

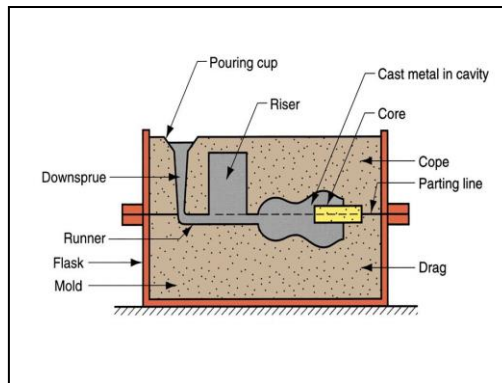


Figure 24. Basic Casting Setup

Try

1. Create a Dumbbell using the casting operation.
2. Create a solid chair leg using the casting process.
3. Create a step based rod of aluminum material using the casting process.

14. Exercises on Riveting Aluminum Sheets

14.1 Cold riveting

Perform the Joining Process using the cold riveting operation where riveting is done at ambient temperature as shown in the Figure 25.

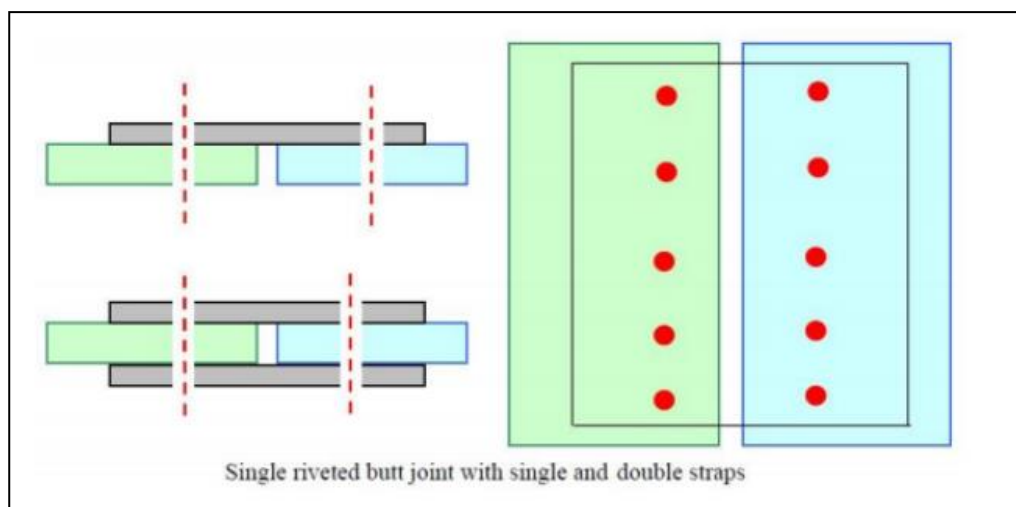


Figure 25. Single riveted butt joint with single & double straps

14.2 Hot riveting

Perform the Joining Process using the hot riveting operation where rivets are initially heated before applying force as shown in the Figure 26.

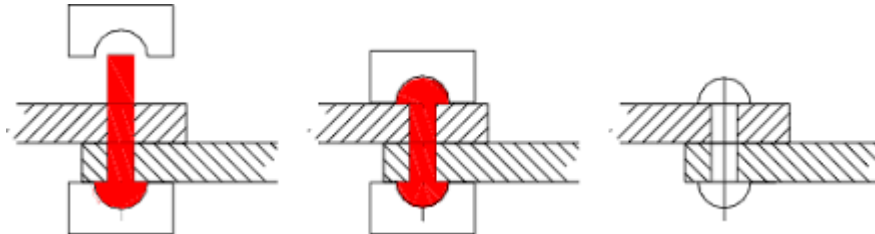


Figure 26. Hot riveting performed on work piece

Try

1. Perform the joining process using riveting of Aluminum Sheets with 5 rivets only.
2. Perform the Joining Process using Riveting of Galvanized sheets with 5 rivets only.
3. Perform the joining process using cold and hot riveting with 5 rivets only.

15. Exercises on Injection Molding

15.1 Blow Molding

Perform the molding process using blow molding and make a new model out of it as shown in Figure 27.

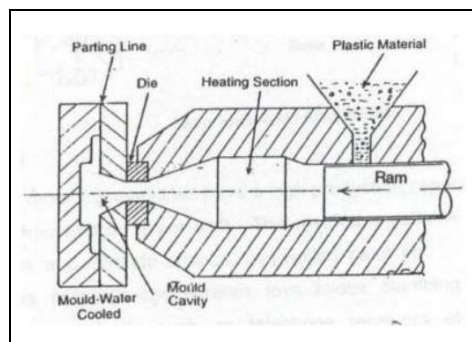


Figure 27. Blow Molding

15.2 Injection Molding

Perform the molding process using Injection Molding and make a new model out of it as shown in Figure 28.

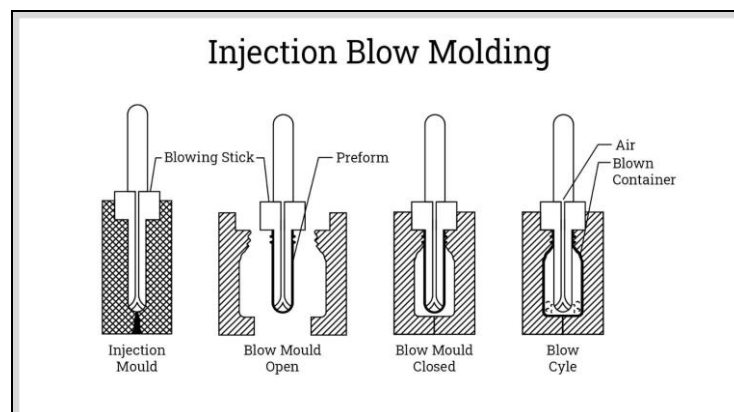


Figure 28. Injection Blow Molding

Try

1. Create a cylindrical mold of Aluminum using the above two process.
2. create a cylindrical mold of copper rod using the two process mentioned above.
3. Create a dumbbell rod with 2.5 kg weight of aluminum metal.

V. TEXTBOOKS:

1. S. Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Addison Wesley 5th edition, 1991.
2. S. C. Keshu, K. K Ganapathy, Aircraft production technology and management, Interline Publishing House, Bangalore, 3rd edition, 1993.
3. Douglas F. Horne, "Aircraft Production Technology", Cambridge University Press, 1st edition, 1986.

VI. REFERENCE BOOKS:

1. S. C. Keshu, K. K Ganapathy, "Aircraft Production Techniques", Interline Publishing House, Bangalore, 3rd edition, 1993.
2. R. K. Jain, "Production Technology", McGraw Hill, 1st edition, 2002
3. O. P. Khanna, M. Lal, "Production Technology", Dhanpat Rai Publications, 5th edition, 1997.

VII. ELECTRONICS RESOURCES:

1. https://akanksha.iare.ac.in/index?route=course/details&course_id=500

VIII. MATERIALS ONLINE

1. Course Template
2. Laboratory Manual