Eshan college of engineering

Farah Mathura

Lab Manual

Mechanical workshop Lab

Branch:- ME, CS, EE, CE, EC

Course:- B.Tech (First Year)

2021 - 22

Total Hours: 38

ME
CS
EE
CE

R. K DIXIT

(Workshop Incharge)

Eshan College of Engineering

Farah, Mathura Code-471

(Approved by AICTE, New Delhi & Affiliated to AKTU, Lucknow)

PRACTICAL PLAN

Branch:- ME, CS, CE, EE **Batch:-** A-1

Lab Name:- Mechanical Workshop B.Tech Sem. II

Week No.	Practical No.	Practical Performed	Date of Practical
1	1.	Introduction of Mechanical Workshop Material, tools and Machines.	18/4/2022
2	2.	To study Vernier Calliper and Micro Meter	18/4/22 26/4
3	3.	To study the various parts and various operation on the lathe machine.	26/4/22
4	4.	To perfom step turning, plane turning, taper turning, knurling and threading operation on the lathe machine.	27/4/22
5	5.	To prepare a half lap corner joint in the carpentry shop.	18/5/22 25/5
6	6.	To prepare a mortise and tenon joint in the carpentry shop.	31/5/22
7	7.	To study ARC & GAS welding machine and practice lap & butt joint.	07/6/22
8	8.	To study TIG & MIG welding.	15/6/22
9	9.	To practice filling, hacksawing, drilling and taping operation on the mild steel flat in the fitting shop.	
10	10.	To study tools and operation in foundry shop.	
	11.	To make a pattern and used in the foundry shop.	
11	12.	To prepare a mould in the foundry shop.	
12	13.	To study the process of casting in the foundry shop.	
13	14.	To study of main features and working parts of CNC lathe machine and accessories that can be used.	
14	15.	To perform different operations on metel using CNC machine.	
15		Practical revision	

ESHAN COLLEGE OF ENGINEERING MECHANICAL ENGINEERING Farah Mathura

R.K. Dixit
Workshop Incharge

Site At : 28Km. Mile Stone, NH-2 Agra- Mathura Highway, Farah, Distt. Mathura
Phone : 0565 – 2961484/86
E-mail Id : lordshiva_trust@rediffmail.com

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Eshan College of Engineering

Farah, Mathura Code-471

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PRACTICAL PLAN

Branch:- ME, CS, CE, EE **Batch:-** A-2

Lab Name:- Mechanical Workshop B.Tech Sem. II

Week No.	Practical No.	Practical Performed	Date of Practical
1	1.	Introduction of Mechanical Workshop Material, tools and Machines.	18/4/2022
2	2.	To study Vernier Calliper and Micro Meter	~~18~~ 26/4/22
3	3.	To study the various parts and various operation on the lathe machine.	26/4/2022
4	4.	To perfom step turning, plane turning, taper turning, knurling and threading operation on the lathe machine.	10/5/2022
5	5.	To prepare a half lap corner joint in the carpentry shop.	17/5/2022 24/5/22
6	6.	To prepare a mortise and tenon joint in the carpentry shop.	31/5/2022
7	7.	To study ARC & GAS welding machine and practice lap & butt joint.	07/6/2022
8	8.	To study TIG & MIG welding.	15/6/22
9	9.	To practice filling, hacksawing, drilling and taping operation on the mild steel flat in the fitting shop.	
10	10.	To study tools and operation in foundry shop.	
	11.	To make a pattern and used in the foundry shop.	
11	12.	To prepare a mould in the foundry shop.	
12	13.	To study the process of casting in the foundry shop.	
13	14.	To study of main features and working parts of CNC lathe machine and accessories that can be used.	
14	15.	To perform different operations on metel using CNC machine.	
15		Practical revision	

ESHAN COLLEGE OF ENGINEERING HEAD DEPTT OF MECHANICAL ENGINEERING Farah Mathura

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PRACTICAL PLAN

Branch:- ME, CS, CE, EE **Batch:-** B-1

Lab Name:- Mechanical Workshop B.Tech Sem. II

Week No.	Practical No.	Practical Performed	Date of Practical
1	1.	Introduction of Mechanical Workshop Material, tools and Machines.	18/4/22
2	2.	To study Vernier Calliper and Micro Meter	18/4 & 22/5/22
3	3.	To study the various parts and various operation on the lathe machine.	27/5/22
4	4.	To perfom step turning, plane turning, taper turning, knurling and threading operation on the lathe machine.	28/5/22
5	5.	To prepare a half lap corner joint in the carpentry shop.	03/6/22
6	6.	To prepare a mortise and tenon joint in the carpentry shop.	04/6/22
7	7.	To study ARC & GAS welding machine and practice lap & butt joint.	10/6/22
8	8.	To study TIG & MIG welding.	15/6/22
9	9.	To practice filling, hacksawing, drilling and taping operation on the mild steel flat in the fitting shop.	
10	10.	To study tools and operation in foundry shop.	
	11.	To make a pattern and used in the foundry shop.	
11	12.	To prepare a mould in the foundry shop.	
12	13.	To study the process of casting in the foundry shop.	
13	14.	To study of main features and working parts of CNC lathe machine and accessories that can be used.	
14	15.	To perform different operations on metel using CNC machine.	
15		Practical revision	

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PRACTICAL PLAN

Branch:- ME, CS, CE, EE **Batch:-** B-2

Lab Name:- Mechanical Workshop B.Tech Sem. II

Week No.	Practical No.	Practical Performed	Date of Practical
1	1.	Introduction of Mechanical Workshop Material, tools and Machines.	18/4/22
2	2.	To study Vernier Calliper and Micro Meter	18/4/22
3	3.	To study the various parts and various operation on the lathe machine.	20/5/22
4	4.	To perfom step turning, plane turning, taper turning, knurling and threading operation on the lathe machine.	27/5/22
5	5.	To prepare a half lap corner joint in the carpentry shop.	28/5/22
6	6.	To prepare a mortise and tenon joint in the carpentry shop.	03/6/22
7	7.	To study ARC & GAS welding machine and practice lap & butt joint.	10/6/22 15/6/22
8	8.	To study TIG & MIG welding.	
9	9.	To practice filling, hacksawing, drilling and taping operation on the mild steel flat in the fitting shop.	
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13	14.	To study of main features and working parts of CNC lathe machine and accessories that can be used.	
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ESHAN COLLEGE OF ENGINEERING

SESSION 2021-22

B.TECH FIRST YEAR - COMPUTER SCIENCE & ENGINEERING

S. NO.	ROLL NO.	NAME	FATHERS NAME
1	2104710100001	ABHIJEET PAL	Sanjay Pal
2	2104710100002	ADITYA PRABHAKAR	Sanjeev Kumar
3	2104710100003	ADNAN KHAN	Chhote Khan
4	2104710100004	AMAN SINGH	Omveer Singh
5	2104710100005	ANJALI SHARMA	Rakesh Kumar
6	2104710100006	ARUN SINGH	Sarvendra Singh
7	2104710100007	ARYAN GUPTA	Sarjoo Gupta
8	2104710100008	ASHWANI TENGURIYA	Mukesh Tenguria
9	2104710100009	AYUSHI SIKARWAR	Pushpendra Singh
10	2104710100010	BALVEER SINGH	Radhey Shyam
11	2104710100011	BRIJESH SHAKYA	Prakash Chandra Shakya
12	2104710100012	CHANCHAL SINGH	Sandeep Kumar Bhartiya
13	2104710100013	CHARU GUPTA	Narayan Gupta
14	2104710100014	CHAUDHARY ALISHA	Satyapal Singh
15	2104710100015	DIVYANSH KUMAR	Lakhmi Chand
16	2104710100016	GAURAV RAWAT	Dharmveer Rawat
17	2104710100017	HARSH	Subhash
18	2104710100018	HARSH	Jay Prakash
19	2104710100019	HARSH DUBEY	Ashish Kumar Dubey
20	2104710100020	HARSH PRATAP SINGH	Bhagwat Singh
21	2104710100021	HARSH VARLANI	Teekam Das
22	2104710100022	ISHITA SHARMA	Sunil Sharma
23	2104710100023	KANHA PARASHAR	Laxmi Narayan
24	2104710100024	KOMAL MATHUR	Prem Chandra
25	2104710100025	KUSHAGRA PRATAP SINGH	Praveen Pratap Singh
26	2104710100026	LAVISH KUMAR	Dinesh Kumar
27	2104710100027	LAXMI PRABHAKAR	Rakesh Prabhakar
28	2104710100028	LOKESH KUMAR VERMA	Girdhari Lal
29	2104710100029	MANISH SINGH	Mukesh Singh
30	2104710100030	MANISHKA SINGH	Rakesh Kumar Singh
31	2104710100031	MEGHA SHARMA	Laxmi Kant Sharma
32	2104710100032	MUKUL SHAKYA	Roop Singh Shakya
33	2104710100033	MUSKAN PAL	Raju Pal
34	2104710100034	NEERAJ SINGH	Gajendra Singh
35	2104710100035	NIKHIL JAIN	Anoop Jain
36	2104710100036	NISHAL GUPTA	Dharmendra Gupta
37	2104710100037	PIYUSH SINGH	Devendra Singh
38	2104710100038	PRASHANT LALWANI	Suresh Lalwani
39	2104710100039	PRAVEEN KUMAR	Harvendra Singh
40	2104710100040	PRIYAM	Gyanendra Kumar
41	2104710100041	RAHUL CHHOUNKAR	Satya Prakash Chhounkar
42	2104710100042	RAINIL AGRAWAL	Sanjay Agrawal
43	2104710100043	RAJESH KUMAR	Chandra Pal Singh
44	2104710100044	RITUL SINGH	Sumer Singh
45	2104710100045	RIYANSHU SHARMA	Sudhir Sha
46	2104710100047	RUPESH TYAGI	Ramveer Tyagi
47	2104710100048	SAHIL	Ajmat Khan
48	2104710100049	SAMULL GUPTA	Dinesh Gupta
49	2104710100050	SANDEEP KUSHWAH	Raudan Singh
50	2104710100051	SAURABH	Jeevan Singh
51	2104710100052	SHAHEEN	Liyakat Ali
52	2104710100053	SHIVANG SAGAR	Mahesh Sagar
53	2104710100054	SHREYA MITTAL	Sunil Kumar Mittal
54	2104710100055	SHUBHAM SINGH	Veer Singh
55	2104710100056	SNEHA AGARWAL	Navneet Agarwal
56	2104710100057	SUMIT	Jay Prakash
57	2104710100058	SURAJ	Nekram Rathor
58	2104710100059	TANISHA AGARWAL	Neeraj Garg
59	2104710100060	TANYA PARIHAR	Vivek Parihar
60	2104710100061	TAUFIQ MUHAMMAD	Anwar Muhammad
61	2104710100062	TEENA PRAJAPATI	Annu Kumar Gola
62	2104710100063	VANSHITA SHARMA	Mukesh Sharma

ESHAN COLLEGE OF ENGINEERING
Farah Mathura

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ESHAN COLLEGE OF ENGINEERING			
SESSION 2021-22			
B.TECH FIRST YEAR - MECHANICAL ENGINEERING			
S. NO.	ROLL NO.	NAME	FATHERS NAME
1	2104710400001	AKASH RATHORE	Ramshevak Rathore
2	2104710400002	DHRUV	Vijay Singh
3	2104710400003	MANJIT KUMAR	Shiv Narayan Singh
4	2104710400004	PRASHANT GOLE	Vijendra Kumar
5	2104710400005	PRIYANSHU GOLA	Mukesh Kumar Gola
6	2104710400006	RAJAT YADAV	Dinesh Kumar
7	2104710400007	RINKU	Tara Chand

ESHAN COLLEGE OF ENGINEERING
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Farah Mathura

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ESHAN COLLEGE OF ENGINEERING

SESSION 2021-22

B.TECH FIRST YEAR - CIVIL ENGG.

S. NO.	ROLL NO.	NAME	FATHERS NAME
1	2104710000001	AFNAN MUZZAM	Khursheed Muazzam
2	2104710000002	AJAY KUMAR	Ram Sewak
3	2104710000003	AJAY KUMAR	Netra Pal Singh
4	2104710000005	DHARAMVEER RAJPUT	Chandra Pal
5	2104710000006	LOVELY	Anil
6	2104710000007	MOHD MARGOOB AHMAD KHAN	Arslan Margoob Khan
7	2104710000008	MONU KUMAR	Ghanendra Kumar
8	2104710000009	REETESH	Suresh Chand
9	2104710000010	RINKESH KUMAR	Satendra Singh
10	2104710000011	RISHABH KUMAR	Sanjay Kumar
11	2104710000012	SHUBHAM KUMAR	Ashok Kumar
12	2104710000013	SONTI	Baladin Singh

ESHAN COLLEGE OF ENGINEERING
Farah Mathura

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ESHAN COLLEGE OF ENGINEERIN

SESSION 2021-22

B.TECH FIRST YEAR - ELECTRICAL ENGINEERIN

S. NO.	ROLL NO.	NAME	FATHERS NAME
1	2104710200001	AKASH MAHOUR	Pappu Mahour
2	2104710200002	ANIKET	Raghuveer
3	2104710200003	ARUN	Vinod Kumar
4	2104710200004	ASHISH SHARMA	Ravish Kumar Sharma
5	2104710200005	KARISHMA	Lat. Bhole Shankar
6	2104710200006	SATYAPAL SINGH	Rakesh Kumar
7	2104710200007	SAURABH	Chhote Lal
8	2104710200008	TAMANNA PRAKASH	Satya Prakash
9	2104710200009	VIMAL KUMAR	Vinod Kumar
10	2104710200010	VISHAL TIWARI	Rajiv Tiwari

ESHAN COLLEGE OF ENGINEERING
Farah Mathura

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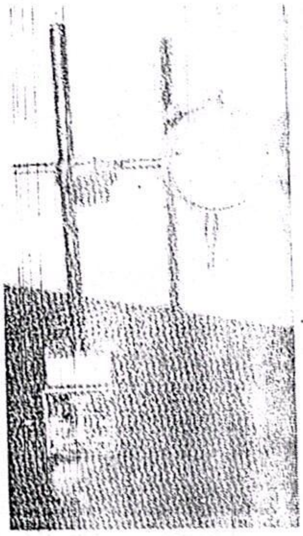
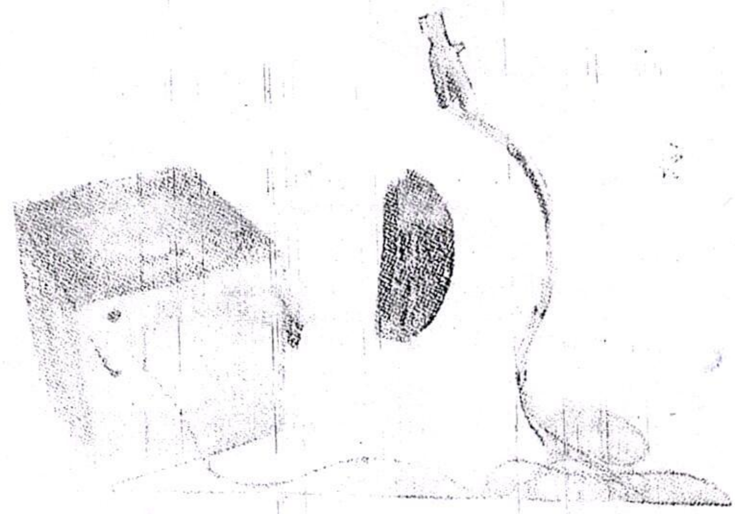
Eshan College of Engineering

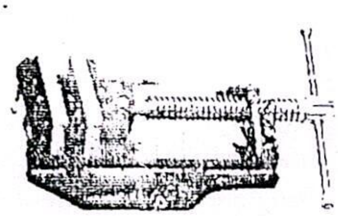
Farah, Mathura

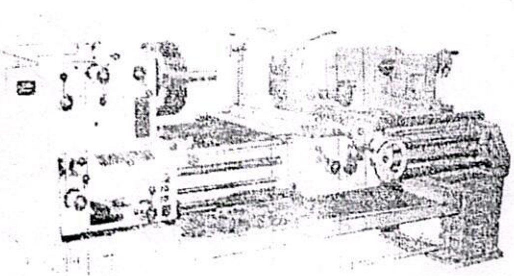
Subject Code : [redacted] KWS-151P/152P

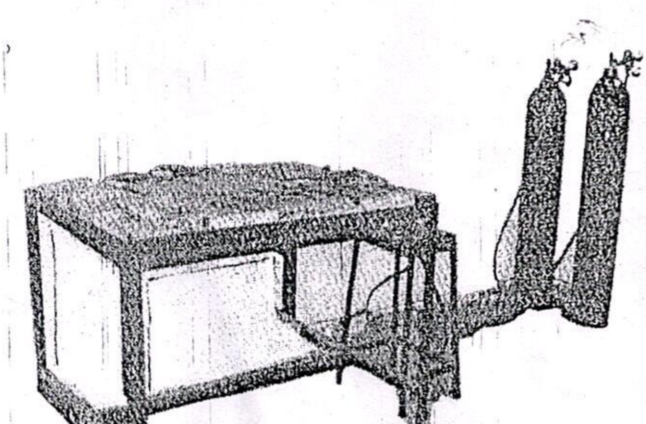
WORKSHOP MANUAL











ESHAN COLLEGE OF ENGINEERING
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R.K. Dixit

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Eshan College of Engineering

Farah, Mathura Code-471

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INSTRUCTION PLAN – PRACTICAL

Branch:- ME, EE, CE & CS. **Batch:-** A & B

Teacher: R.K. DIXIT (Workshop Incharge) Dept.:- ME

Course No: **Subject Code** KWS-251P Course Title:- Mech. Workshop

Text Book

S. No.	Book Title	Author	Publisher
1	General Work Shop Practice	D.K. Shrivastava	Jai Prakash Nath
2	Work Shop Practice	H.S. Bawa	McGraw Hill

Reference Books

S. No.	Book Title	Author	Publisher
1	Work Shop Technology	RS Khurmi & J.K. Gupta	S. Chand
2	Work Shop Practice	K.K. Vidhyarthi	Pragti Prakashan
3	Work Shop Technology	B.S. Raghuwanshi	Dhanpat Rai & Co

Relevant websites

S. No.	Web address (exact page address)
1	YouTube

ESHAN COLLEGE OF ENGINEERING HEAD DEPTT OF MECHANICAL ENGINEERING Farah Mathura

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Phone : 0565 – 2961484/86

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Revised Structure B. Tech 1st Year (Common)

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

REVISED EVALUATION SCHEME
&
SYLLABUS

FOR

B. TECH. I YEAR

(All Branch except Agriculture (AG) and Biotechnology (BT)

ON

AICTE MODEL CURRICULUM)

[Effective from the Session: 2020-21]

(4)

KWS-151P KWS-251P	MECHANICAL WORKSHOP LAB	0L:1T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

The students will be able to		Blooms Taxonomy
CO1	Use various engineering materials, tools, machines and measuring equipments.	K3
CO2	Perform machine operations in lathe and CNC machine.	K3
CO3	Perform manufacturing operations on components in fitting and carpentry shop.	K3
CO4	Perform operations in welding, moulding, casting and gas cutting.	K3
CO5	Fabricate a job by 3D printing manufacturing technique	K3

S. No.	Mechanical Workshop	Duration
1	**Introduction to Mechanical workshop material, tools and machines**	
	To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.	3 Hours
	To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section.	
	To determine the least count of vernier caliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.	
2	**Machine shop**	
	Demonstration of working, construction and accessories for Lathe machine	3 Hours
	Perform operations on Lathe - Facing, Plane Turning, step turning, taper turning, threading, knurling and parting.	
3	**Fitting shop**	
	1. Practice marking operations. 2. Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling, Grinding.	3 Hours
4	**Carpentry Shop**	
	Study of Carpentry Tools, Equipment and different joints.	
	Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint	3 Hours
5	**Welding Shop**	
	Introduction to BI standards and reading of welding drawings.	

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	Practice of Making following operations Butt Joint Lap Joint TIG Welding MIG Welding	**6 Hours**
6	**Moulding and Casting Shop**	
	Introduction to Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes Demo of mould preparation and Aluminum casting Practice – Study and Preparation of Plastic mould	**6 Hours**
7	**CNC Shop**	
	Study of main features and working parts of CNC machine and accessories that can be used. Perform different operations on metal components using any CNC machines	**6 Hours**
8	**To prepare a product using 3D printing**	**3 Hours**

Reference Books:

1. Workshop Practice, H S Bawa, McGraw Hill
2. Mechanical Workshop Practice, K C John, PHI
3. Workshop Practice Vol 1, and Vol 2, by HazraChoudhary , Media promoters and Publications
4. CNC Fundamentals and Programming, By P. M. Agrawal, V. J. Patel, Charotar Publication.

EXPERIMENT

Object: To study different types of materials used in work shop

Steels are widely used materials in the industry. They are the alloys of iron, carbon and other elements such as silicon, phosphorus, sulphur and manganese. The carbon present in the form of iron-carbide(Fe_3C) increases the hardness and strength of the steel.

Steels are classified based on their chemical composition, applications, and methods of production.

Types of Steel and Their Properties

Steel can be broadly categorized into four groups based on their chemical compositions:

1. Carbon Steels
2. Alloy Steels
3. Stainless Steels
4. Tool Steels

Carbon Steels

Carbon steels contain trace amounts of alloying elements and account for 90% of total steel production. Carbon steels can be further categorized into three groups depending on their carbon content:

- Low Carbon Steels/Mild Steels contain up to 0.3% carbon
- Medium Carbon Steels contain 0.3-0.6% carbon
- High Carbon Steels contain more than 0.6% carbon

Alloy Steels

Alloy steels contain alloying elements (e.g. manganese, silicon, nickel, titanium, copper, chromium, and aluminum) in varying proportions in order to manipulate the steel's properties, such as its hardenability, corrosion resistance, strength, formability, weldability or ductility. Applications for alloys steel include pipelines, auto parts, transformers, power generators and electric motors.

Stainless Steels

Stainless steels generally contain between 10-20% chromium as the main alloying element and are valued for high corrosion resistance. With over 11% chromium, steel is about 200 times more resistant to corrosion than mild steel. These steels can be divided into three groups based on their crystalline structure:

- **Austenitic:** Austenitic steels are non-magnetic and non-heat-treatable, and generally contain 18% chromium, 8% nickel and less than 0.8% carbon. Austenitic steels form the largest portion of the global stainless steel market and are often used in food processing equipment, kitchen utensils, and piping.
- **Ferritic:** Ferritic steels contain trace amounts of nickel, 12-17% chromium, less than 0.1% carbon, along with other alloying elements, such as molybdenum, aluminum or titanium. These magnetic steels cannot be hardened by heat treatment but can be strengthened by cold working.
- **Martensitic**: Martensitic steels contain 11-17% chromium, less than 0.4% nickel, and up to 1.2% carbon. These magnetic and heat-treatable steels are used in knives, cutting tools, as well as dental and surgical equipment.

Tool Steels

Tool steels contain tungsten, molybdenum, cobalt and vanadium in varying quantities to increase heat resistance and durability, making them ideal for cutting and drilling equipment.

Steel products can also be divided by their shapes and related applications:

- Long/Tubular Products include bars and rods, rails, wires, angles, pipes, and shapes and sections. These products are commonly used in the automotive and construction sectors.
- Flat Products include plates, sheets, coils, and strips. These materials are mainly used in automotive parts, appliances, packaging, shipbuilding, and construction.
- Other Products include valves, fittings, and flanges and are mainly used as piping materials.

Mild steel:

As your go-to steel supplier in Utah, we at Wasatch Steel have a wide selection of steel options. There are numerous types, categories and grades of steel out there, each with its own specific set of properties, benefits and potential drawbacks.

One such category is mild steel, a term that's common for describing a very general type of steel. What exactly is mild steel describing, how is it made, and what is it used for? Let's take a look.

Properties

Mild steel is a type of carbon steel with low carbon content, and it's also called low carbon steel. Ranges will vary based on the source, but will generally be between 0.05 percent to 0.25 percent by weight. Higher carbon steel, on the other hand, will range between 0.30 percent and 2.0 percent carbon. Beyond this, steel is classified as cast iron.

Mild steel is not an alloy steel, and therefore does not contain large amounts of other elements besides iron. This makes it different from other steel types in a few ways:

- More ductile, machinable and weldable than high carbon and other steels
- Nearly impossible to harden and strengthen during heating and quenching
- Very little carbon and other alloying elements to block dislocations in crystal structure, which means less tensile strength
- High amounts of iron and ferrite, making it magnetic
- Subject to oxidation if not properly coated
- Relatively affordable compared to other steels

How It's Made

Mild steel is made in a similar manner to other carbon steels. One common method is a combination of iron and coal melted together in a blast furnace, then solidified into a rectangular shape. Hot rolling or cold drawing will then be used to bring the mild steel down to the desired size.

Common Applications

There are several common areas in which mild steel might be used:

- Structural steel
- Signs
- Cars
- Furniture and decorations
- Wire
- Fencing
- Nails

Cast Iron

Cast iron is a ferrous alloy that is made by re-melting pig iron in a capola furnace until it liquefies. The molten iron is poured into molds or casts to produce casting iron products of the required dimensions. Based on the application of cast iron, the alloying elements added to the furnace differ. The commonly added alloy elements are carbon followed by silicon. The other alloying elements added are chromium, molybdenum, copper, titanium, vanadium, etc.

How is cast iron classified?

Based on the alloying elements added, the variation in the solidification of the cast iron and heat treatment used, the microstructure of the cast iron can vary. Depending upon the application and the preferred mechanical properties, iron castings can be classified into the following.

Types of cast iron

White cast iron

When the white cast iron is fractured, white coloured cracks are seen throughout because of the presence of carbide impurities. White cast iron is hard but brittle. It has lower silicon content and low melting point. The carbon present in the white cast iron precipitates and forms large particles that increase the hardness of the cast iron. It is abrasive resistant as well as cost-effective making them useful in various applications like lifter bars and shell liners in grinding mills, wear surfaces of pumps, balls and rings of coal pulverisers, etc.

Grey cast iron

Grey is the most versatile and widely used cast iron. The presence of carbon leads to formation of graphite flakes that does not allow cracks to pass through, when the material breaks. Instead, as the material breaks the graphite initiates numerous new cracks. The fractured cast iron is greyish in colour, which also gives it the name. The graphite flakes make the grey cast iron exhibit low shock resistance. They also lack elasticity and have low tensile strength.

However, the graphite fakes gives the cast iron excellent machinability, damping features as well as good lubricating properties making them useful in many industrial applications. The graphite microstructure of the cast iron has a matrix that consists of ferrite, pearlite or a combination of two. The molten grey iron has greater fluidity and they expand well during the solidification or freezing of cast iron. This has made them useful in industries like agriculture, automobile, textile mills, etc.

Malleable cast iron

Malleable cast iron is basically white iron that undergoes heat treatment to convert the carbide into graphite. The resultant cast iron has properties that vary from both grey and white cast iron. In case of malleable cast iron, the graphite structure is formed into irregularly shaped spheroidal particles rather than flakes that are usually present in gray cast iron. This make the malleable cast iron behave like low-carbon steel. There is considerable shrinkage that results in reduced production of cast iron as well increased costs. Malleable cast iron can be identified easily by the blunt boundaries.

EXPERIMENT NO. 1

Object

Use of vernier caliper.

Apparatus

Vernier caliper, work piece etc.

Principle

Vernier caliper is based upon vernier principle.

Theory

It has two scales — main scale (fixed scale) and vernier scale (sliding scale). Difference of least counts of two scales gives least count of the vernier caliper. Two scales are used simultaneously for measurement.

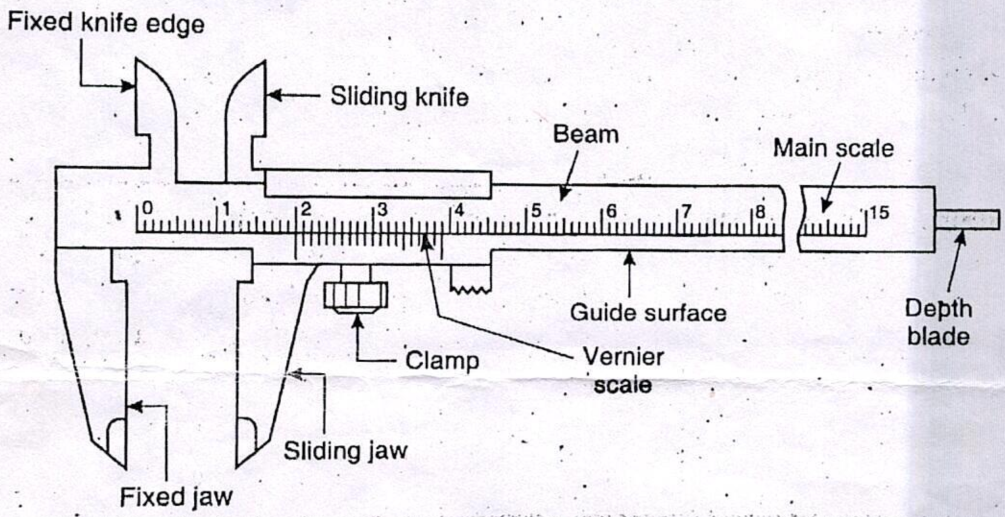


Fig. 11.26

Least count

Least count of the main scale = 1 mm.

There are 20 divisions on vernier scale which are equal to $20-1=19$ mm of the main scale.

Hence least count of the vernier scale $=\frac{19}{20}$ mm.

Least count = Least count of main scale – Least count of vernier scale

$$=1\text{ mm}-\frac{19}{20}\text{ mm}$$

$$=\frac{1}{20}\text{ mm}$$

$$=0\cdot05\text{ mm}$$

Also, $$\text{least count}=\frac{1\text{ mm}}{\text{Number of divisions on vernier scale}}$$

$$=\frac{1\text{ mm}}{20}=0\cdot05\text{ mm}$$

Method of reading : Note the zero mark position of vernier scale on main scale. It gives main scale reading.

Identify division of vernier scale which coincides exactly with a division of main scale. Note down serial number of the vernier scale division. Therefore,

Final reading = Main scale reading + Division of vernier scale × Least count of vernier caliper

Procedure

These steps are followed :

1. Determine least count of the vernier caliper.
2. Clean jaws and determine zero error.
3. Adjust zero error from your observations.
4. Note down respective readings.

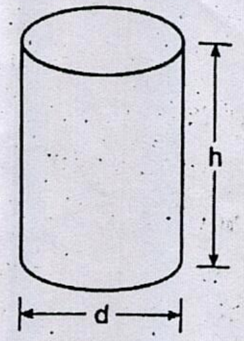


Fig. 11.27

Observations

Make =

Least count = ... mm

Range = ... mm

Zero error = ... mm

Sl. No.	Parameter	Main scale reading (x)	Vernier scale division No. (p)	Vernier scale reading $y = p \times$ least count	Corrected reading $= (x + y) \pm$ zero error	Average Reading
1.						
2.	d					... mm
3.						
1.						
2.	h					... mm
3.						

Precautions

Following care should be taken :

1. Measuring jaws should be cleaned properly.
2. Locking screw should be very loose.
3. Adjust zero error, if any.
4. Hold work piece in left hand and vernier caliper in right hand.
5. Use internal faces of jaws, avoid edges.

EXPERIMENT NO. 2

Object

Use of outside micrometer for measurement.

Appratus

Outside micrometer of range 0 – 25 mm, small work piece.

Principle

Instrument is based upon screw and screw nut principle.

Theory

We know that axial movement of a threaded part in one complete rotation is equal to the pitch of the thread. If pitch is divided into 50 equal parts, then each part will correspond to axial movement of the spindle by an amount equal to *pitch*/50.

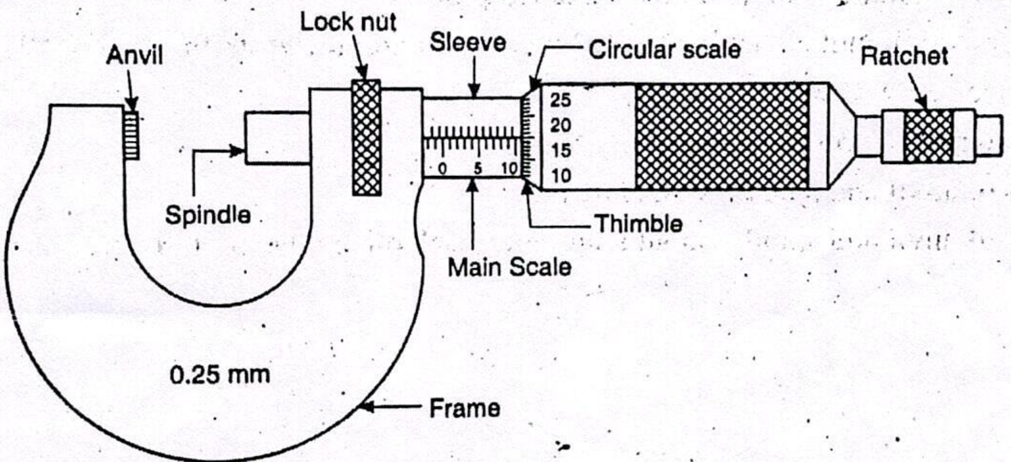


Fig. 11.28

Least count

$$\text{Least count of the micrometer} = \frac{\text{Pitch (mm)}}{\text{Number of divisions on thimble}}$$

$$= \frac{0.5\text{ mm}}{50}$$

$$= 0.01\text{ mm}$$

Observation

Investigation of work piece is shown in fig. 11.27

Make =

Least count = ... mm

Range = ... mm

Zero error = ... mm

Sl. No.	Parameter	Main scale reading (x)	Circular scale division No. (p)	Circular scale reading $y = p.$ least count	Corrected reading $= (x + y) \pm$ zero error	Average Reading
1.						
2.	d					... mm
3.						
1.						
2.	h					... mm
3.						

Precautions

Following care should be taken :

1. Anvil and spindle faces should be cleaned properly.
2. Work piece should be held in the left hand and micrometer in the right hand.
3. Find zero error, if any.
4. Use ratchet for applying measuring force.
5. Faces of anvil and spindle should be flat.
6. Faces of anvil and spindle should not touch each other when not in use.

EXPERIMENT NO. 3

Object

Use of height gauge and vernier caliper.

Apparatus

Vernier height gauge, vernier caliper, surface plate, work piece.

Principle

Vernier height gauge and vernier caliper are based on vernier principle.

Theory

Vernier height gauge is used to measure vertical dimensions. It requires a surface plate for resting. Work piece also rests on same surface. Hence surface plate provides a reference.

Vernier caliper is used to measure thickness, diameters, length etc.

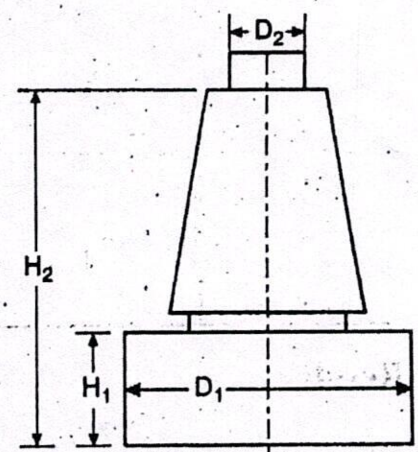


Fig. 11.29

Observation

1. ***Vernier height gauge***

Make =

Least count = ... mm

Range = ... mm

Zero error = ... mm

SL. No.	Parameter	Main Scale Reading (x) (mm)	Vernier Scale Reading (y) (mm)	Total $x + y \times LC$	Corrected Reading (mm)	Average Reading (mm)
1.						
2.	H_1					
3.						
1.						
2.	H_2					
3.						

2. ***Vernier caliper***

Make =

Least count = ... mm

Range = ... mm

Zero error = ... mm

Sl. No.	Parameter	Main Scale Reading (x) (mm)	Vernier Scale Reading (y) (mm)	Total $x + y \times LC$	Corrected Reading (mm)	Average Reading (mm)
1.						
2.	D_1					
3.						
1.						
2.	D_2					
3.						

Result

Height, $H_1 = \ldots$ mm

$H_2 = \ldots$ mm

Diameters, $D_1 = \ldots$ mm

$D_2 = \ldots$ mm

Precautions

Following care should be taken :

1. Clean surface plate and other measuring instruments.
2. Adjust zero error, if present.
3. Handle measuring instruments with care.
4. Use 'fine adjustment screw' for accuracy of the process.

EX-03

(16) (1) Hours - 02

ESHAN COLLEGE OF ENGINEERING,

FARAH, MATHURA,

MACHINE SHOP

OBJECT- To study various parts. & various operations on the lathe machine.

INTRODUCTION

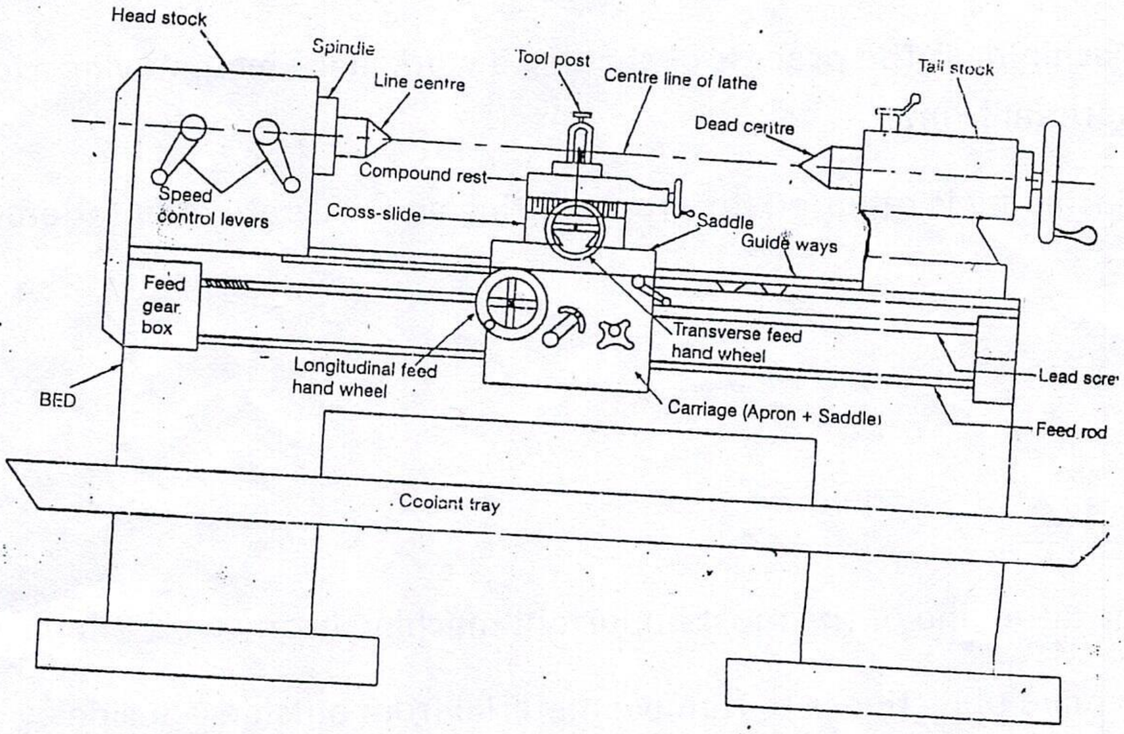
Machining is the process of shaping a work piece by removing excess material from it.

Machining is required for proper fitting and accurate orientation.

LATHE

The lathe one of the most important machine in any work shop.

Its main objective is to remove material from outside & inside by rotating the against a cutting tool. Through lathe is used to produce cylindrical work. Yet it may also be used for many other purpose such as drilling threading grinding etc.


Head stock
Spindle
Line centre
Tool post
Centre line of lathe
Tail stock
Dead centre
Compound rest
Speed control levers
Cross-slide
Saddle
Guide ways
Feed gear box
Transverse feed hand wheel
Longitudinal feed hand wheel
Lead scre
BED
Carriage (Apron + Saddle
Feed rod
Coolant tray

Lathe

MACHINE TOOLS

The machine tools used for machining are broadly classified into three types.

1. General purpose - (used for general machining like turning, drilling, etc.)
   Example: Lathe, drilling machine

2. Special purpose - (used for special machining like gear cutting)
   Example: Capstan and turret lathe, gear hobbing machine.

3. Automatic machine tools - (used for mass production of components)
   Example: CNC (Computer Numerical Control) lathe, CNC milling machine.

Simple Turning

Simple machining like turning is carried out in a lathe. A general-purpose lathe may be used to produce cylindrical, flat or curvilinear surface and also to drill holes.

Components of a Lathe

1. Headstock: The headstock supports spindle and spindle bearing and houses the speed changing mechanisms. The spindle holds the chuck that holds the work piece.

2. Lathe Bed: The lathe bed is the base of the machine; the headstock, tailstock, compound rest and carriage are mounted on the bed. The lathe bed is rigid and absorbs vibrations while machining.

3. Tailstock: The tailstock supports the long size work piece that is held in the headstock. It is also used to hold the drilling tool.

4. Carriage: The carriage moves over the lathe bed. It consists of two parts: saddle and apron. The saddle carries the cross-slide over which the

compound rest is fitted. The cross-slide is used to produce a transverse movement for the cutting tool

5. Compound rest: The compound rest carries the tool post on a swivel base. This arrangement helps cutting tool movement at an angle to the lathe axis in taper turning.

6. Tool post: The tool post that is located on top of the compound rest holds the tool. The tool post can be adjusted to a convenient working position.

7. Feed Rod, 8. Lead Screw 9. Cross Slide

Work Holding Devices

- Work holding devices are used to hold the work piece firmly during the operation. Following are the commonly used work holding devices in lathe.

(1) Three-jaw Chuck: It is a self-centering chuck. A chuck key is engaged and rotated in one of the jaws, which simultaneously moves the other jaws to grip the work piece. (2) Four Jaw Chuck

(3) Magnetic Chuck

Mandrel: It is used for holding a work piece with pre-drilled holes. The work piece is inserted in the mandrel by force-fit and then held firmly in a chuck.

Feed Mechanism

Feed refers to the movement of the tool during metal cutting operation. The tool movement may be longitudinal, transverse or angular. The tool movement parallel to the lathe axis is called longitudinal movement; the movement perpendicular to the lathe axis is called transverse or cross movement; the movement at specified angle to the lathe axis is called angular movement. Angular movement is used for taper turning operation. Metal removal rate is high in larger feed rate but the surface finish will be poor. Usually high feed is given for rough turning and less feed is given to get smooth surface finish. Feed is expressed in mm/revolution or mm/minute.

Operations using Lathe

Simple machining operations that can be done in a lathe are as follows.

1. **Turning**: Turning is the process of removing excess material from a work piece to produce a cylindrical surface

2. **Facing**: Facing is done to remove material at the ends of a work piece to produce a flat surface.

3. **Taper turning**: Taper turning is the process of removing excess material from a work piece to produce a conical surface.

4. **Knurling**: The process of embossing a diamond shaped pattern on a work piece having a cylindrical surface is called knurling.

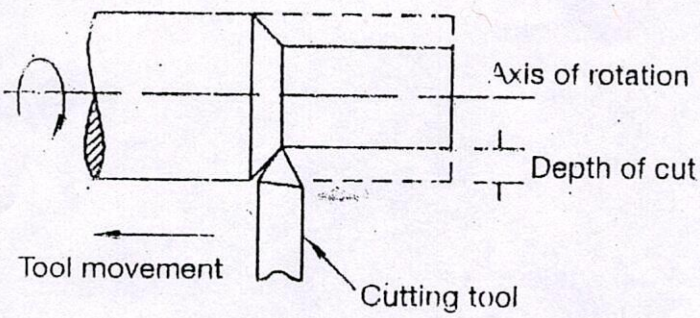
5. **Chamfering**: Chamfering is the process of beveling the extreme ends of a work piece. Usually the chamfering angle is set to 30 or 45 degrees.

6. **Grooving**: Grooving removes a small length (2mm or 3mm) of material from a work piece.

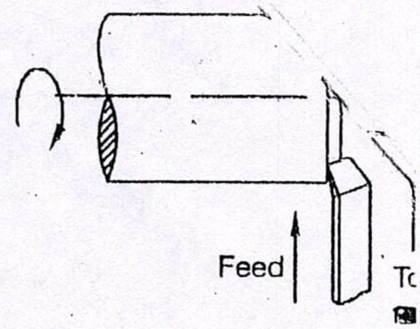
7. **Drilling**: Drilling is done to produce a hole in a work piece. The work piece is held in the chuck and the drilling tool is held in the tailstock. Feed is given by rotating the wheel slowly in the tailstock.

(8) Step Turning. (9) Boring. (10) Reami

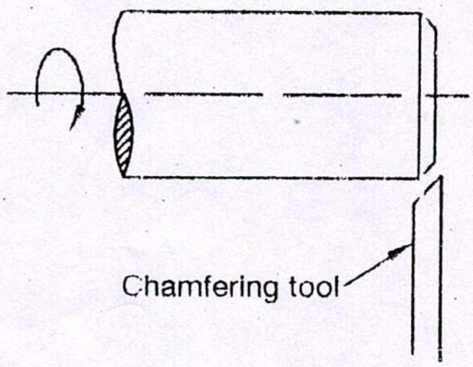
(11) Threading.



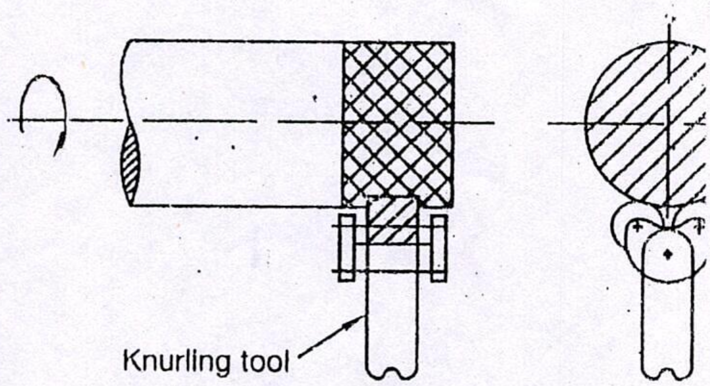
Turning



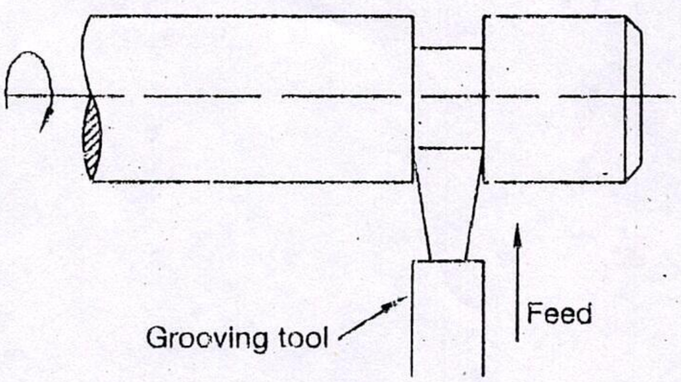
Facing



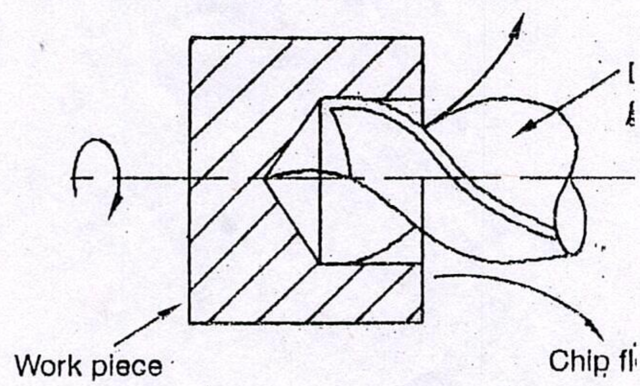
Chamfering



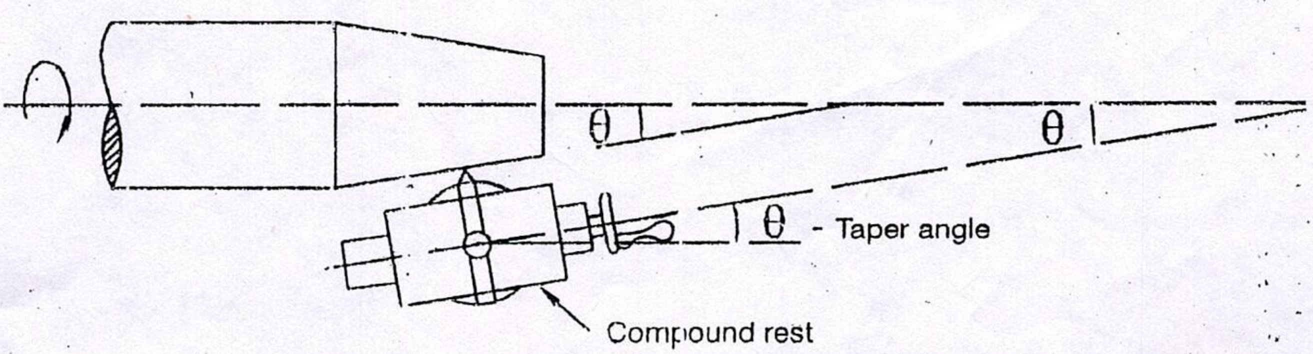
Knurling



Grooving



Drilling



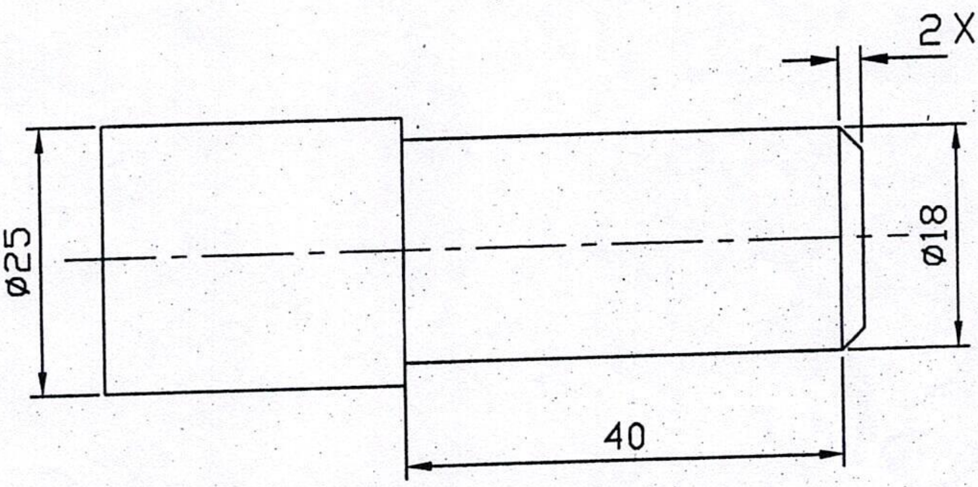
Taper Turning

EX-

OBJECT – To Performe, turning, facing and chamfering on a cylindrical work piece.

Tool Required →

1. Lathe Machine
2. Three Jaw chuck
3. Chuck Key
4. Steel Scale
5. Single-Point cutting Tool.



Procedure

1. First loosen the jaws in the chuck using the chuck key to position the work piece, and then tighten the jaws.

2. Fix the cutting tool in the tool post.

3. Switch on the lathe and move the carriage near the work piece and give a small cross feed, and then move the carriage longitudinally to the required length slowly.

4. Bring the carriage to the original position, give a small cross feed and move the carriage longitudinally. Repeat this step until the required diameter is obtained. It is good practice to check the diameter of the work piece regularly using a vernier caliper.

5. To get smooth surface, give very small feed when the diameter is nearing the required value.

6. To face the end surface of the work piece, move the carriage to make the tool touch the end surface of the work piece.

7. Give a small feed in longitudinal direction, and then move the tool towards the axis of the work piece using the cross-slide to complete facing.

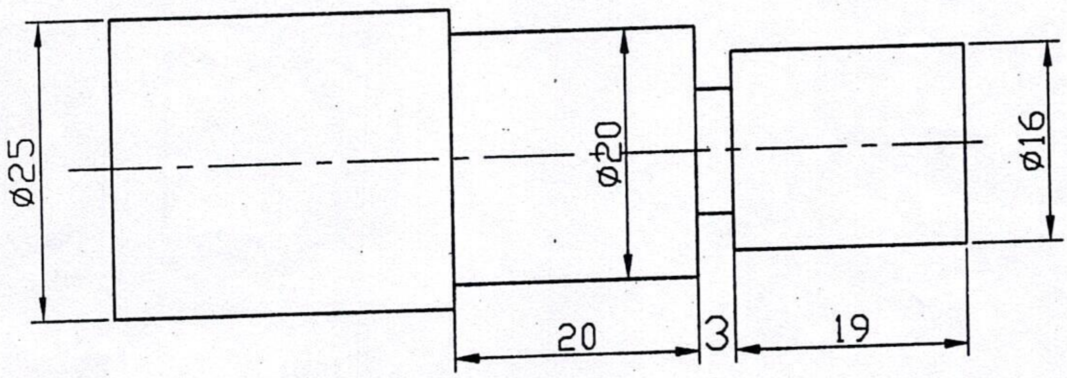
8. To chamfer the end, set the cross-slide to the required angle and give a small feed in longitudinal direction and then move the tool using the cross-slide. Repeat this step by giving more feed and complete chamfering.

Result

The given work piece is turned to the given diameter, faced and chamfered.

OBJECT— To Perform Step Turning, grooving on a mild Steel Work Piece.

Tool Required → (1) Lathe machine.
(2) Three Jaw chuck
(3) chuck Key
(4) Steel Scale
(5) Single-Point cutting Tool
(6) Grooving Tool



Procedure

1. First loosen the jaws in the chuck using the chuck key to position the work piece, and then tighten the jaws.

2. Fix the cutting tool in the tool post.

3. Switch on the lathe and move the carriage near the work piece and give a small cross feed, and then move the carriage longitudinally to the required length slowly.

4. Bring the carriage to the original position, give a small cross feed and move the carriage longitudinally. Repeat this step until the required diameter is obtained. In between the machining process, check the diameters using a vernier caliper.

5. When the diameter is nearing the required value, give small feed to get a smooth surface.

6. To make a groove on the work piece, load the grooving tool in the tool post and move the carriage to make the tool touch work piece.

7. Slowly give the feed using the cross slide to complete the grooving.

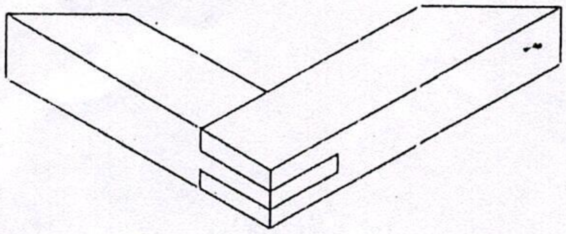
Result

The given work piece is turned and grooved to the required diameter.

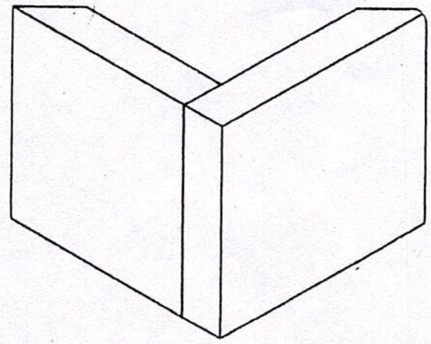
EX: 01 (26)

CARPENTRY.

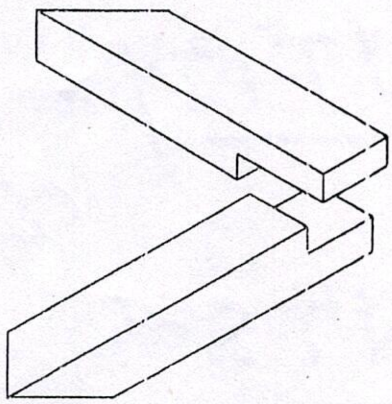
JOINTS.



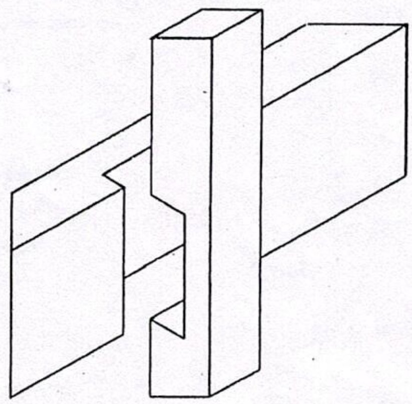
Bridle joint



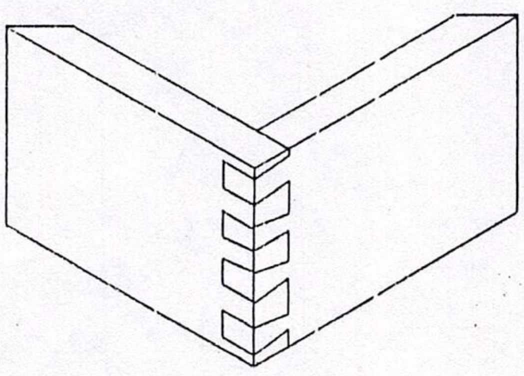
Butt joint



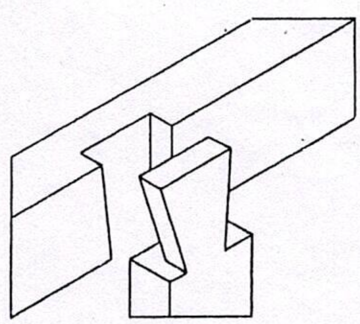
Corner having joint



Cross halving joint



Dovetail joint



Dovetail halving joint

Dovetail Halving Joint

Dovetail halving joint is similar to the corner halving or cross halving joints but has the added strength of dovetail angles. It resists pulling forces well.

Dowel Joint

Dowel joint is similar to the butt joint but has added strength of dowels that are inserted into the joint.

Housing Joint

Housing joint is used primarily to construct shelves in cabinets. There are many variations to the housing joint, the strongest being the dovetail housing joint.

Lap Joint

Lap joint used to build cabinets and boxes. It has the added strength of a rebate cut, but it will probably need glue and pins to get full value.

Mitred Lap Joint

Mitred lap joint is similar to the lap joint but gives a better finish. In mitred lap joint, a planed angle is used to bring the edges together.

Mitred Butt Joint

Mitred butt joint is a frame maker's joint that gives more surface area than a simple butt joint. The joint is usually reinforced with nails and glue.

Mortice and Tenon Joint

Mortice and tenon joint is used in the construction of building frames. It is a very supportive mechanical joint used by furniture makers and joiners. The mortice and tenon joint gives good area for both glue and wedge fixing.

(29)

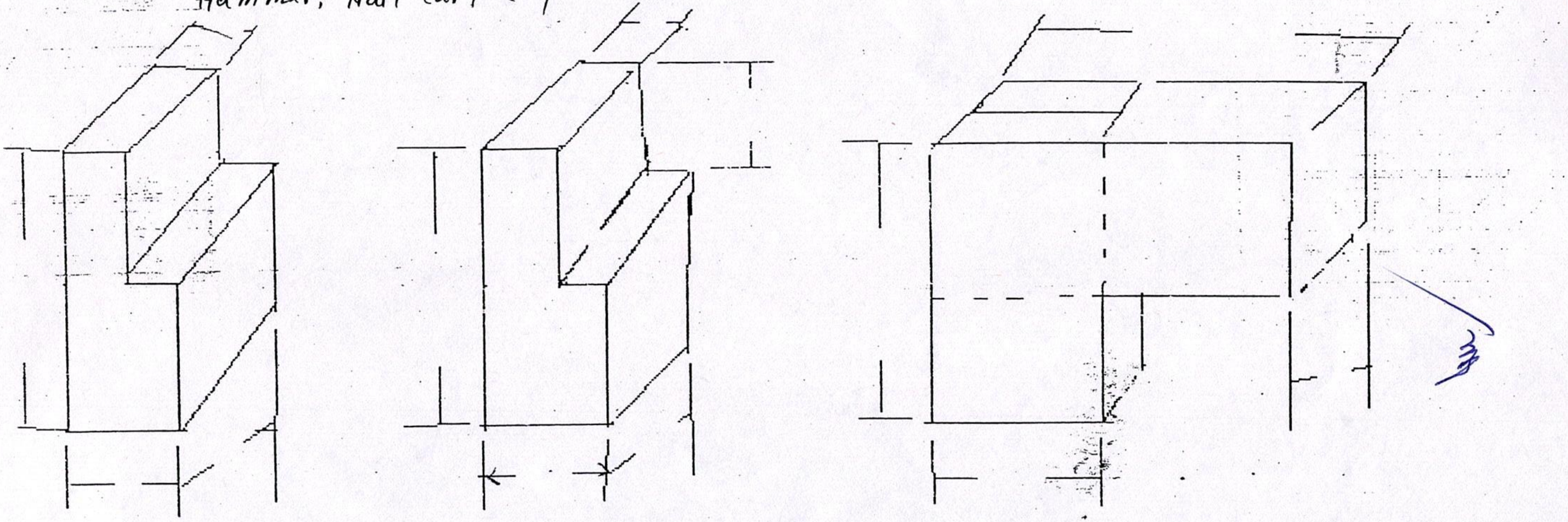
Ex-01

Half Lap Corner Joint

Ex-4 H-2

Object:- To make a Half Lap Corner Joint in the Carpentry Shop.

Tools used:- steel scale, Try Square, marking gauge, Rip Saw, iron jack plane, Hammer, Nail carpentry vench vice et.c.



Procedure:- the JOB is clamped properly in the vice and any two adjacent surface are planned to get right plane. the accuracy of right angle is checked by using try square.

→ the JOB is cut into halves using rip saw.

→ Proper marking is done on the two portions based on the planned surfaces.

→ one half is cut according to the given dimensions + using tenon saw and firmer chisel

→ finally the accuracy and proper dimensions are verified by using steel Rule and try square

Result→

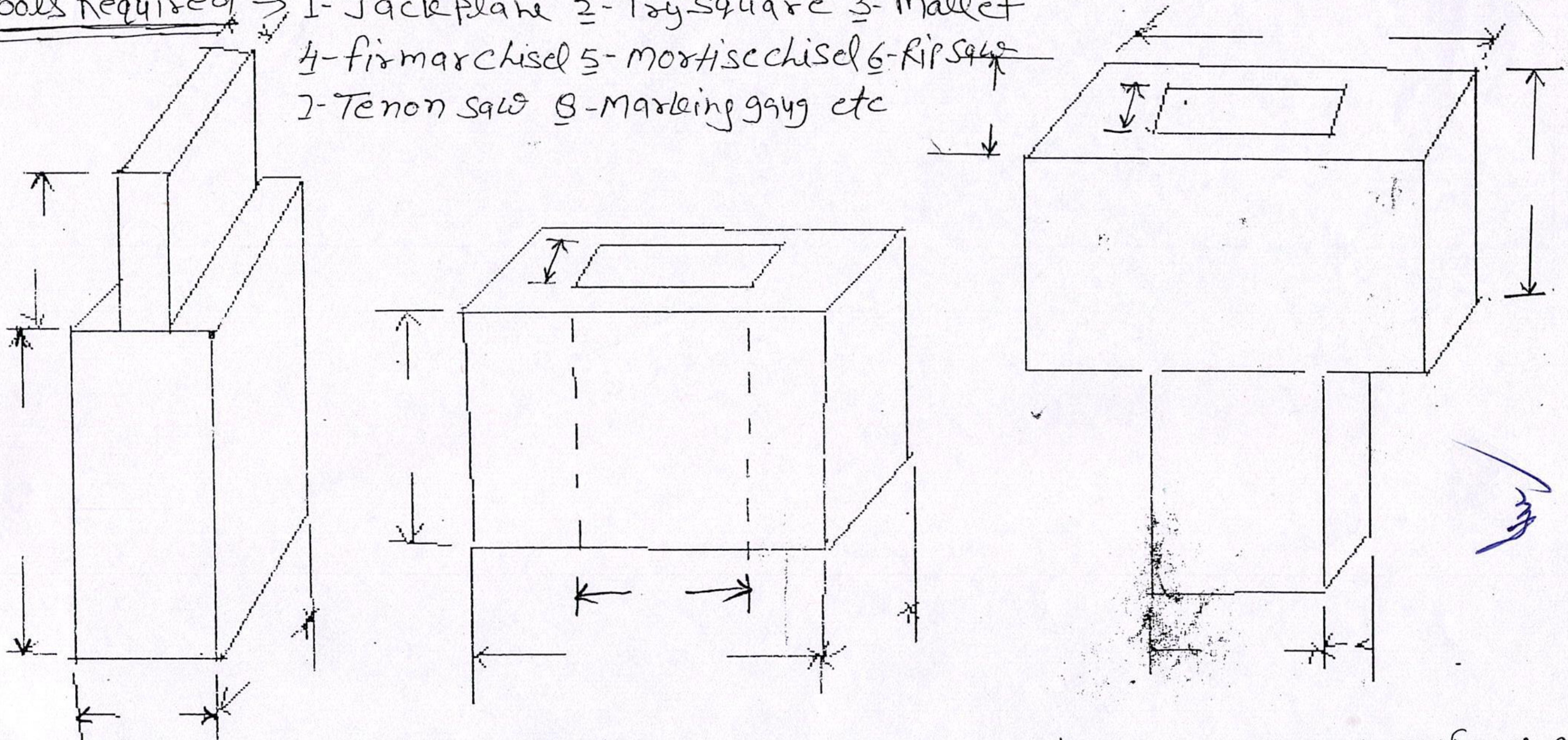
Object → To make a mortise and tenon joint in the carpentry shop

Ex-02

Mortige & tenon Joint

Ex-5 M-2

Tools Required → 1- Jack plane 2- Try square 3- Mallet
4- firmar chisel 5- mortise chisel 6- Rip saw
7- Tenon saw 8- Marking gaug etc



Procedure → 1- The Job is clamped properly in the vice and any two adjacent surfaces are planned to get right angle using Jack plane. the accuracy of right angle is checked by using try square.
2- The Job is cut into two halves using rip saw.
3- Proper marking is made on the two portions based on the planned surface.
4- one half is cut into 'T' shaped lock having the required dimensions using firmar and mortise chis

Result →

EX-06

OBJECT- To study various parts in the Arc welding. [redacted]

INTRODUCTION

Arc welding is widely used method of joining the metal parts. Here the source of heat is an electric arc. Arc welding is a group of welding processes wherein heating is produced with an electric arc or arcs, mostly without the application of pressure and with or without the use of filler metal, depending upon the base plate thickness.

ARC WELDING PRINCIPLE

In arc welding, arc is generated between the positive pole of D.C. (direct current) called anode and negative pole of D.C. called cathode. When these two poles are brought together, and separated for a small distance (1.5 to 3 mm) such that the current continues to flow through a path of ionized particles, called plasma, an electric arc is formed. Since the resistance of this ionized gas column is high, so more ions will flow from anode to the cathode. Heat is generated as the ions strike the cathode.

TOOLS AND EQUIPMENTS USED IN ARC WELDING PROCESS :

ELECTRIC ARC WELDING SET :

As per their construction and application, welding transformer set is mainly divided into following types :

1. A.C. Transformer or A.C. welding machine
2. Motor Generator Set
3. Engine Generator Set
4. Rectifier Set.

1. A.C. Welding Transformer Set : These are simple in construction containing a step down transformer set oil cooled/air cooled, which supplies different current values as per requirement. These are available single phase to three phase in market. It has no moving parts. So possesses low maintenance cost and low installation cost.

2. Motor Generator Set : It is a D.C. generator set in which electric motor and alternator are mounted on same shaft and it produces D.C. power as per requirement for welding. These are generally made in 20 Amp. – 1000 Amp. range. These are made single operator and multi-operator welding machine or both type.

3. Engine Generator Set : It is very much similar to motor generator set except that consists a diesel or petrol engine in place of motor as in motor generator set. It is useful on site work where electrical power is not available.

4. Rectifier Set : These are A.C. step down transformer set containing rectifiers which change A.C. in to D.C. by virtue of which operator can use both types of power (A.C. or D.C. but only one at same time). It is useful where requirement of current and polarity etc. changes repeatedly. These are more economical for running and maintenance etc. then both engine and motor generator sets but it has more installation cost.

1. Welding Transformer : In arc welding process a step down transformer is used to increase output current and to reduce output voltage. These are available in single phase (220 V) and double phase (440 V) or both. As per requirement these are available in both type such as A.C.

2. Electrode : Electrode may be defined as a filler metal rod used to fill up the gap between joints during welding procedure. Generally these are in wire shape and made up of different als as per requirement. It works to transport current from electrode holder to work metal which es for arc development. It is specified as follows :

The important factors affecting the selection of suitable electrode for specific welding process are as mentioned below :

1. Current – A.C./D.C.
2. Thickness and composition of work metal.
3. Welding position – Horizontal, vertical or overhead.
4. Gap in between the joints of work metal – Size dia. of electrode.
5. According to physical properties required such as strength, ductility and penetration etc.

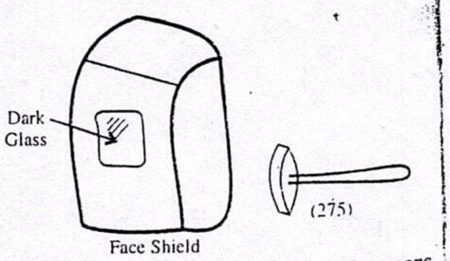
3. Electrode holder : It is used for electrode holding. It consists two jaws. One jaw is fixed type and another jaw is movable which is operated by a screw or spring connected arm mounted over insulated handle.

4. Welding Cable : It is generally made up of many thin copper wires collecting them together and wrapped in a suitabe insulating material. It is specified by cross-section of cable and current carrying capacity of electrode etc.

5. Cable connection/Lug/Thimble : It is made up of aluminium, copper, brass and alloys of these etc. It is used for connecting cable with terminal of welding machine. It is important to make connections tight enough to prevent any sparking etc.

6. Earthing Clamp : These are generally made up of M.S., brass and copper etc. It is used to connect earthing terminal of welding machine with work table etc.

7. Welding Cabin and Table : Welding table is generally made up of iron with iron top and placed in a welding cabin. Welding cabin is made up by any suitable thermal resistant material which can isolate the surrounding by the heat and light emitted during welding process. A suitable draught is made for exhausting the gas generated during welding process.



Hand Shield   Chipping Hammers

8. Face Mask/Hand Shield : These are used for protection of face and eyes from the spatter, ultraviolet and infrared rays etc. generated during welding process. It is made up of fibre sheet and black glass are fitted to look at weld. These shield are of two types – one has handle which is used by gripping in hand and another type of shield has mounting strip by which it is fixed on head of operator and there is no need for gripping it by hand. Black glass used in these shield are available in different shades of black colour depending upon the use (current application for welding).

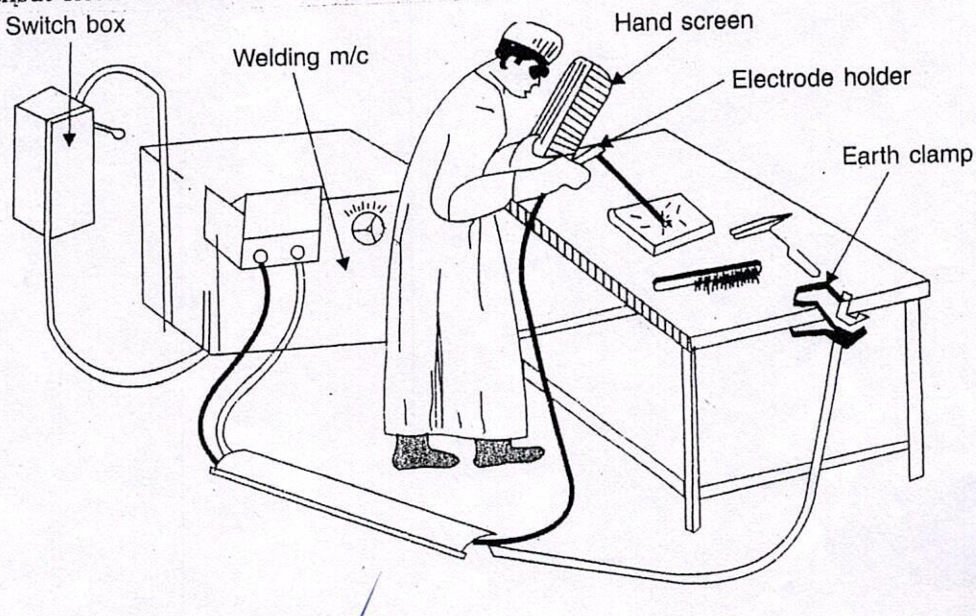
9. Goggles/Safety Glass : These are similar as the ordinary goggles except that these have safety guards at the side of glass to provide safety to eye from side along with front direction.

10. Chipping hammers : These are hammers having pointed or sharp striking face and used for removing slag and spatter.

11. Wire Brush : Wire brush is used for removing slags and unwanted materials from metal surface in fine way than chipping hammer.

12. Gloves and Apron : These are used for protection against spatter and spark etc.

13. Electrode carrier : These are used for carrying number of electrodes at welding place with operator. Usually at welding place the moisture present on ground may humid the electrodes placed without electrode carrier.



(*a*) Set up of Metal Arc Welding (FMAW).

EX-06.

Object* To joint two given metal Plates by a Square butt joint in arc welding.

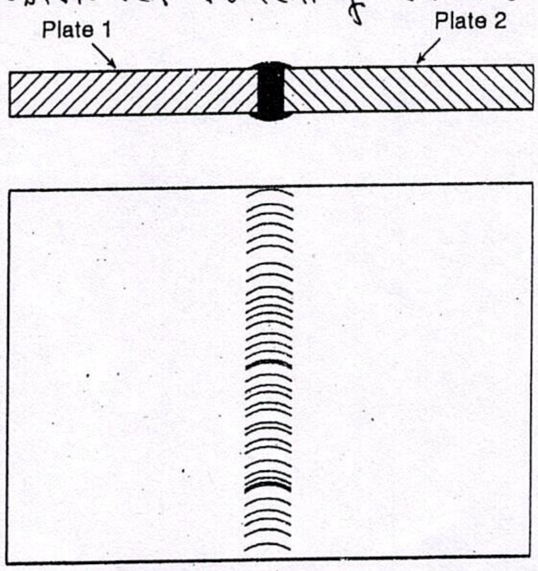
Tools Required* (1). Welding transformer (2). Welding rods. (3). Safety gloves (4). Goggle (5). Chipping hammer (6). flat file, etc.

Procedure

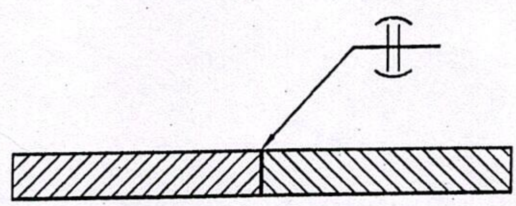
…e Surface to be Welded is cleaned and the edges of the Plates may be …iled for Perfect joint and more Strength.

The welding rod is held in the electrode holder and the ground …lamp is clamped to the plate to be welded.

The Plates to be welded are positioned touching each other (butting) and …g weld is done on the ends to …oid the movement of the plates …ring welding.



Representation of square butt weld



Symbolic representation

…ow Start welding from one end of the Plates.

The electric arc produced melts the welding rod and joins the …wo metal plates. Maintain a gap of 3mm b/w the plate and the welding rod.

Complete the welding Process by removing slag using chipping hammer.

Result*

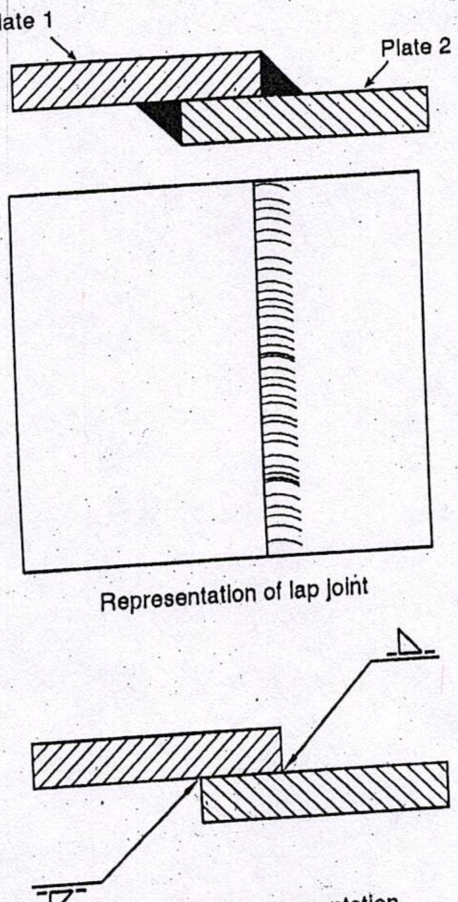
Thus the two metal Plates are welded in Square butt joint.

…ecaution* (1 to 5).

* Object * To joint given metal plates by a lap joint in arc welding.

* Tools Required *

(1). Welding transformer (2). Welding rods (3). Safety gloves (4). Goggle (5). Chipping hammer (6). Flat file etc.



Representation of lap joint

Symbolic representation

* Procedure *

(1). The surface to be welded is cleaned and the edges of the plates may be filed for perfect joint and more strength.

(2). The welding rod is held in the electrode holder and the ground clamp is clamped to the plate to be welded.

(3). The plates to be welded are positioned overlapping and tag weld is done on the ends to avoid the movement of the plates during welding.

(4). Now start welding from one end of the plates.

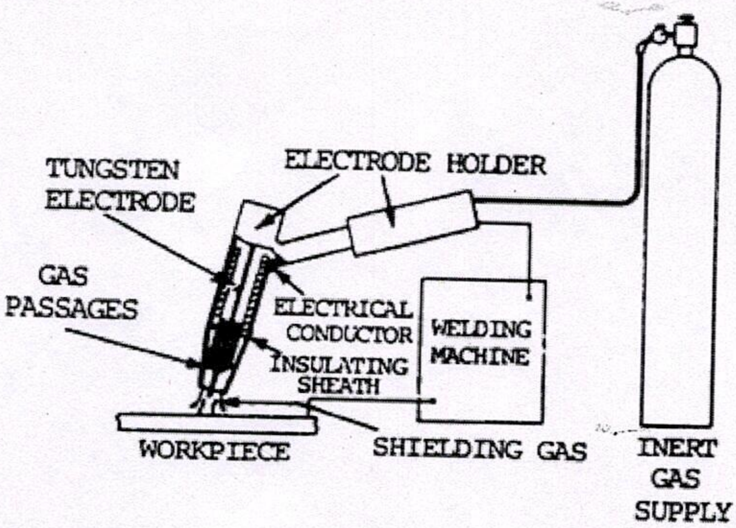
(5). The electric arc produced melts the welding rod and joints the two metal plates. Maintain a gap of 3mm b/w the plate and the welding rod.

Experiment

Aim: To study Tungsten Inert Gas (TIO) Shielded Are Welding

Apparatus: Apparatus for tungsten inert gas welding

Theory: The set up for tungsten inert gas welding is shown in the following figure



Characteristics:

(1) This is a welding process in which coalescence is produced by heating with an electric arc between a metal electrode and the work. Shielding of the arc and the molten metal is obtained through the use of an inert gas. A tungsten electrode is used because of its high melting point, and in the presence of the inert gas the electrode is practically no consuming.

(2) Filler metal, if used, is added to the weld in the same manner as in oxyacetylene welding. leaning action that is beneficial when welding aluminum, magnesium, beryllium, copper, and some alloys containing additions of aluminum or beryllium which form refractory oxides.

(3) With the tungsten inert welding process, welds can be made in all positions, and in practically all metals, without the use of flux. No significant amount of oxide is formed; therefore, fluxes are not required.

(4) Either direct current (dc) or alternating current (ac) electricity can be used to perform inert gas arc welding operations, depending on the type metal to be welded. When welding aluminum with this welding process, the use of alternating current is preferred. The use of alternating current produces an oxide cleaning action, resulting in a better weld in aluminum. Direct current, reverse polarity (dcrp) ie electrode positive, is used for welding these metals in very thin sections.

Type of Inert Gas Used:

(1) Argon is the type of inert gas most commonly used because it affords better control of the molten metal pool and of the arc. The argon gas also forms an envelope which protects the molten metal from contact with the air. The results are that the weld metal remains brighter, is less cloudy, and produces a better quality weld which is free of contamination.

(2) Helium gas is used in cases where more intense heat or deep penetration into the base metal is required. Therefore, helium is used only when performing high speed welding, or when welding or cutting thicker metal.

Tungsten Electrodes:

(1) Tungsten can withstand higher temperatures than the normal electrode used in arc welding. But it can also be consumed if the temperature of the arc is too hot. Therefore, there is a limit to the current carrying capacity of tungsten electrodes. This limit, together with the beating characteristics of the work in terms of polarity, has led to the useof alternating current for almost all tungsten arc welding.

The size of the electrode is determined by the current which, in turn, is a function of the material thickness. Non consuming electrodes for TIG welding are of four types: pure tungsten, tungsten containing 1 or 2 percent thorium, and tungsten containing 0.3 to 0.5 percent zirconium. Each type of tungsten electrode can he identified by painted end marks, as follows:

(a) Green - pure tungsten.
(b) Yellow - 1 percent thorium.
(c) Red - 2 percent thorium.
(d) Brown - 0.3 to 0.5 percent zirconium.

(3)) Pure tungsten (99.5 percent tungsten) electrodes are generally used on less •critical welding operations rather than the tungstens which are alloyed. This type ol'clectrode has a relatively low current carrying capacity and a low resistance to contamination.

(4) Thoriated tungsten electrodes (1 - or 2 percent thorium) are superior to pure tungsten electrodes because of their higher electron output, better arc-starting and arc stability, high current-carrying capacity, longer life, and greater resistance to contamination.

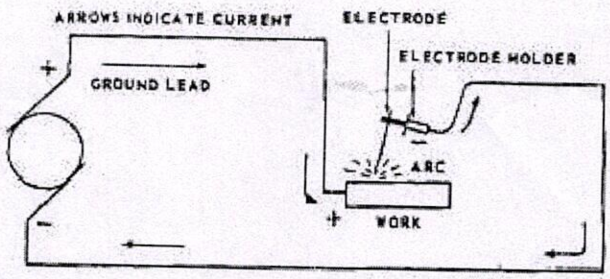
(5) Tungsten electrodes containing 0.3 to 0.5 percent zirconium generally fall between pure tungsten electrodes and thoriated tungsten electrodes in terms of performance.

(6) Welding Current:

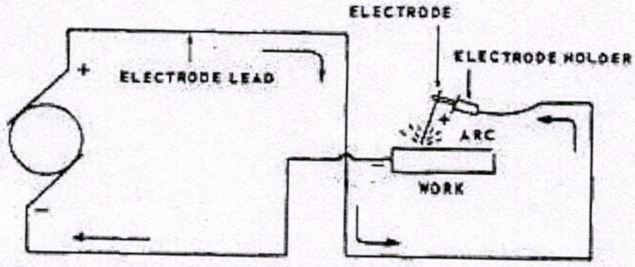
Standard alternating current welding transformers, with 100 volts or less open circuit potential, arc used in this method of welding. These transformers usually require a superimposed high frequency voltage for starting and maintaining the arc. The polarity to be used with a specific type of electrode is established by the manufacturer.

Direct Current Welding:

(a) In direct current welding, the welding current circuit may be hooked up as either straight polarity (dcsp) or reverse polarity (dcrp). For dcsp, the machine connections are electrode negative and workpiece positive as shown in the figure. The electron flow in the circuit formed by this connection is from the electrode to the workpiece (base metal plate). For dcrp, the welding machine connections are electrode positive, and work piece negative, as shown in figure the electron flow in this circuit is from the work piece to the electrode.



STRAIGHT POLARITY



REVERSED POLARITY

Advantages:

The TIG shielded arc wilding process has certain advantages over other welding processes as described in the following subparagraphs.

(I) It provides freedom from the need for using a flux, either on the work or on the filler rod, thus eliminating the flux removal problem.

(2) It permits visual control while welding in any position.

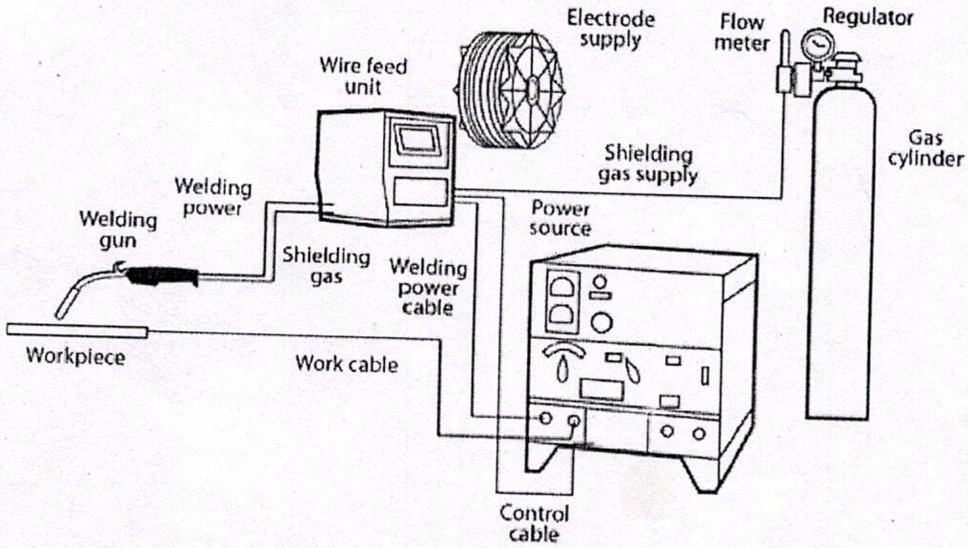
(3) It produces distortion in the base metal.

Experiment

Aim: To study metal gas welding or shielded arc welding

Apparatus: Set up for metal inert gas welding (MIG)

Theory: The apparatus for MIG is shown in the figure below:



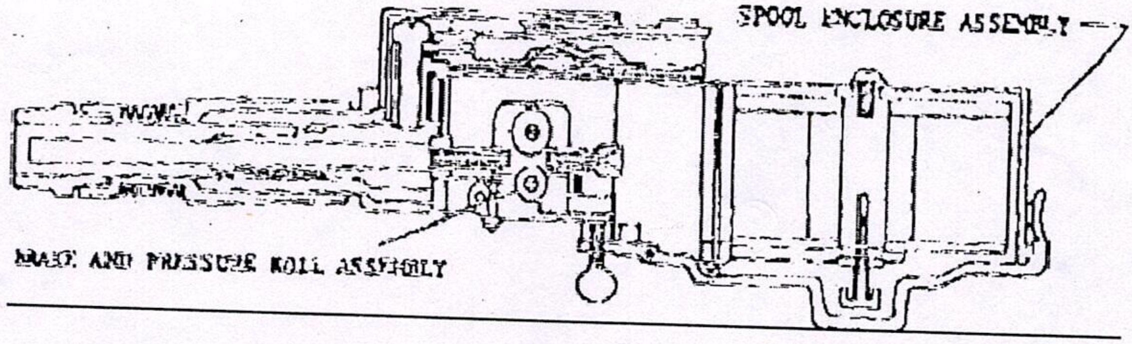
(1) This welding process is relatively new and only recently has been adopted for use by the U.S. Army in the field. Much use of this welding process will be made in the repair of aluminum hull tracked vehicles.

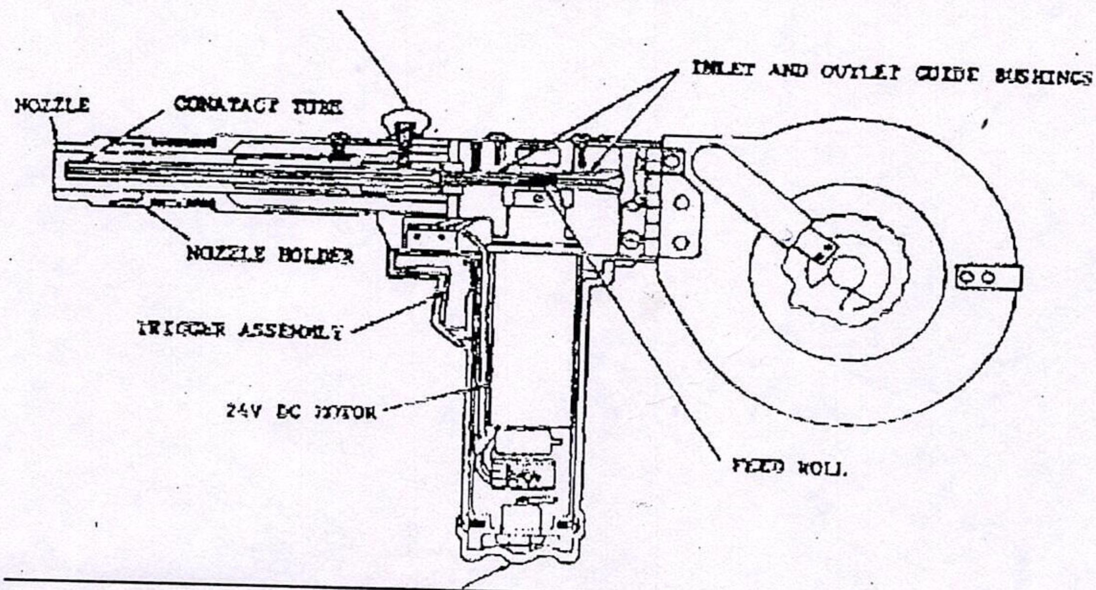
(2) Gas metal-arc (MIG) welding is process in which a consumable, bare wire electrode, is fed into a weld at I controlled rate of speed. A blanket of inert gas (argon, helium, or a mixture of the two as used in TIG welding) shields the weld zone from contamination. This process produces high welds without the use of fluxes or the necessity of post cleaning the weld.

(3) The MIG welding unit is designed for manual welding with small diameter wire electrodes using a spool-on-gun torch as shown in figure on the following page. (There are MIG welding systems that have the spool located away from the torch gun, but the principle operation is the same as for the type system discussed here. The complete system consisting of the torch, a voltage control box, and a welding contactor are shown in figure. The torch handle contains n complete motor and gear reduction unit that pulls the welding wire electrode from a 4 inch diameter spool containing one pound of wire electrode; mounted in the rear of the torch.

Three basic sizes of wire electrode may be used: 3/32 inch; 3/64 inch; and 1/16 inch. Any type of metal may be welded, provided the welding wire electrode is of the same composition as the base metal.

(4) The unit is designed for use with an ac-dc conventional, constant current type welding power Supply.





MIG Welding Equipment Components.

(1) **Contact Tube.** This tube is made of copper with a hole 0.01 to 0.02 inch larger than the electrode. The contact tube and guide bushings must be changed when changing the size of the electrode. Electric power is transmitted through the contact tube to the electrode.

(2) **Nozzle and Holder.** The nozzle is made of copper to dissipate heat and chrome-plated to reflect the heat. The holder is made of stainless steel and is connected t6 an insulating material which prevents an arc from being drawn between the nozzle and ground in case the gun comes in contact with the work.

(3) **Inlet and Outlet Guide Bushings.** The bushings are made of nylon for longer wear. They must be changed to suit the wire electrode size when the electrode size is changed.

(4) **Pressure Roll Assembly.** This is a smooth roller, under spring tension, which pushes the wire electrode against the Feed and allows the wire to be pulled from the spool. A thumbscrew applies tension as required.

(5) **Motor.** When the inch button is depressed, the current for running the motor comes from the 110 volt ac-dc source, and the motor pulls the wire electrode from the spool at the required rate of feed. The current for this motor is supplied by the welding generator.

(6) **Spool Enclosure Assembly.** This assembly is made of plastic which prevents arc spatter from jamming the wire electrode on the spool. A small window allows the operator to visually cheek the amount of' wire electrode remaining on the spool.

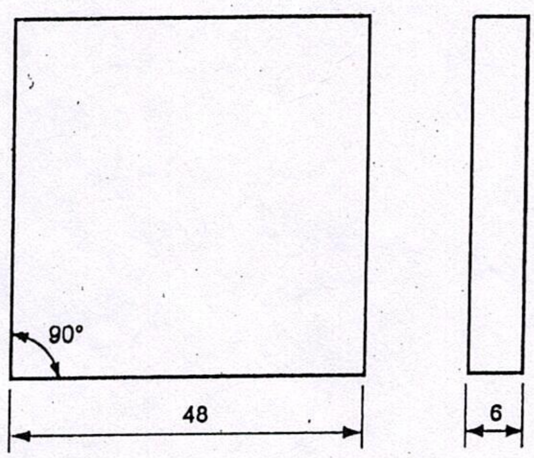
- Insulate yourself from work and ground.
- Do not touch live electrical parts.
- Keep all panels and covers securely inplace
- Keep your head out of the fumes.
- Ventilate area, or use breathing device.
- Do not weld near flammable material.
- Watch for fire; keep extinguisher nearby
- Wear welding helmet with correct shade of filter.
- Wear correct eye, ear, and body protection.
- Allow cooling period before touching welded metal

H-3

EX- 12

Object :- To practice measuring, marking, filling, and Hacksawing on the m.s plate.

Tools used :- Bench vice, Try Square, steel scale, Files, Hand Hacksaw, Hammer, center punch, Feeler gauge, Surface Plate, e.t.c.



Square filling

All dimensions in mm

Procedure

1. The original dimensions of the workpiece are checked using the steel rule.
2. Then the workpiece is clamped properly in the bench vice and using a flat file any two sides of the workpiece are filed. Check whether the two sides are at right angles using the try-square.
3. The given dimensions are marked using the surface plate and surface gauge by referring the two sides as bases.
4. Punch marks are put on the line marked using prick punch.
5. Now the remaining two faces are filed.
6. Filing is continued until the required dimensions and smooth surface of the workpiece is obtained.

Result

Thus the square filing with required dimensions is obtained.

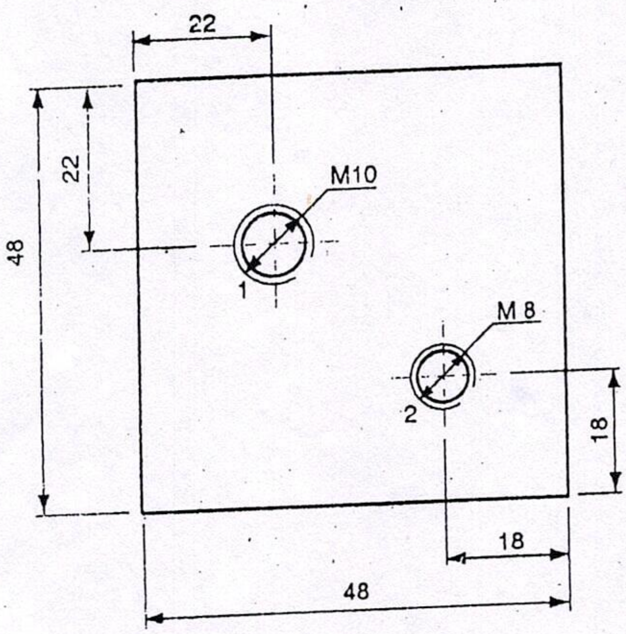
(43)

Ex-07-13

H-2

OBJECT → To Practice drilling and Tapping. On the Mild Steel flat in the fitting shop

Tool Used — Bench vice, Try-square, Steel rule, Centre punch, files, surface Plate, Ball Peen Hammer, drilling machine, Tap set.



Drilling and tapping

To find drill diameter for hole 1:

Drill diameter = 0.8 × threaded hole diameter

= 0.8 × 10 mm

= 8 mm

To find drill diameter for hole 2:

Drill diameter = 0.8 × threaded hole diameters

= 0.8 × 8 mm

= 6.4 mm

This can be rounded to the nearest available diameter drill bit, say 6 mm.

Procedure

1. The original dimensions of the workpiece are checked using the steel rule.

2. Then the workpiece is clamped properly in the bench vice and using a flat file any two sides of the workpiece are filed. Check whether the two sides are at right angles using the try-square.

3. The centres of the holes are marked using the surface plate and surface gauge by referring the two sides as bases.

4. Punch marks are made at the centre of the holes marked in step 3 using the centre punch.

5. Clamp the workpiece in the machine vice on the drilling machine table.

6. Load the required diameter drilling tool and adjust the table to set the point end of the tool to the centre of the hole to be drilled.

7. Switch on the drilling machine and give feed manually to drill the hole. The same procedure is repeated to drill the next hole.

8. Use the rough tap and medium tap to cut the thread roughly and to remove the excess material.

9. Use the fine tap to complete the thread. Now the internal thread is made for the given dimension. The same procedure is repeated to get the next hole threaded.

Result

Thus the holes are drilled and internal threads are made.

Ex- 07

45

OBJECT- To study various tools in the foundry shop.

INTRODUCTION

Foundry is a process of forming different shapes and sizes of metals in their molten state. It is also called as metal casting. The shape of the metal cast obtained depends on the shape and size of the cavity produced in sand mould by using a wooden model. This wooden model is called a pattern.

The foundry process involves three steps:

(i) making the required pattern;

(ii) moulding process to produce the cavity in sand using the pattern;

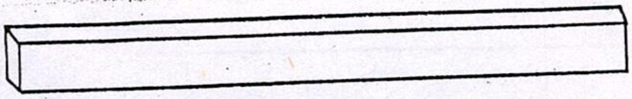
(iii) pouring the molten metal into the cavity to get the casting.

Pattern

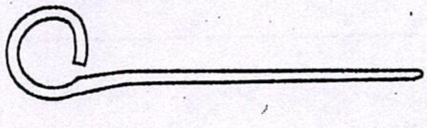
A pattern is normally a wooden model which is the facsimile of the cast/ product to be made. There are many types of patterns and are either one-piece or two-pieces.

Moulding Box

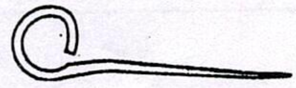
A moulding box is normally a rectangular wooden/metal box with bottom and top surfaces open. The upper part (cope) and the lower part (drag) are aligned properly.



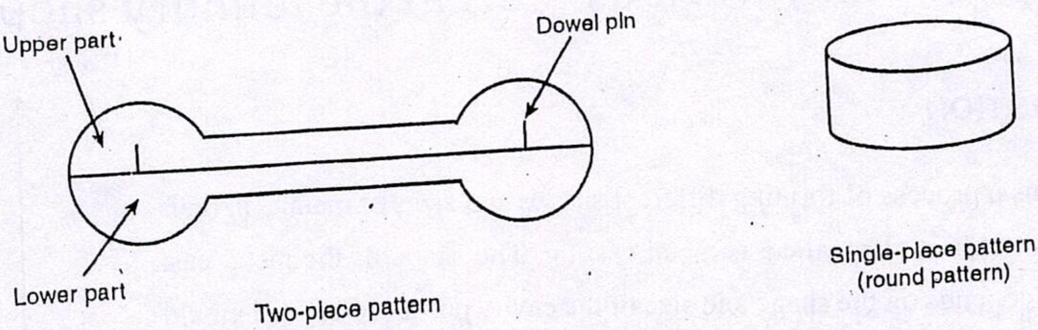
Strike-off bar



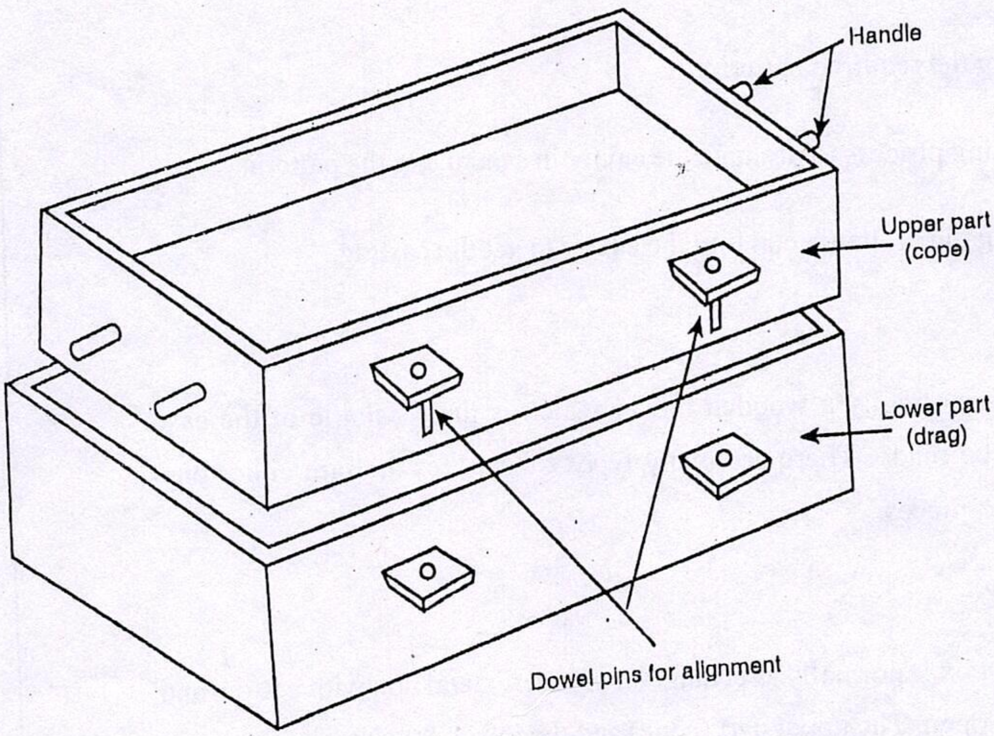
Vent wire

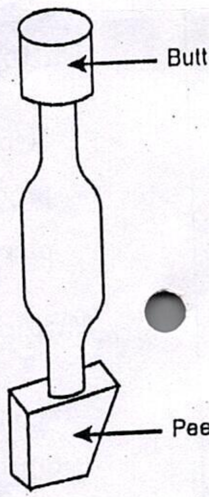


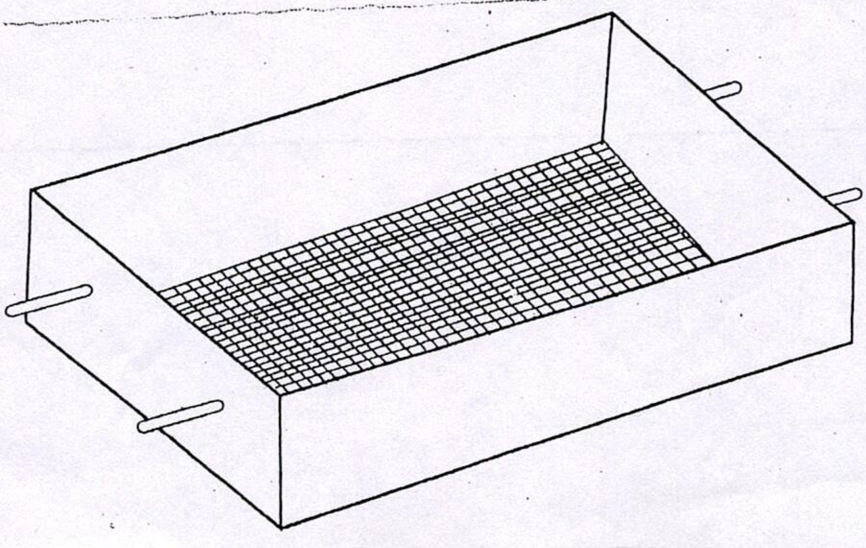
Draw spike

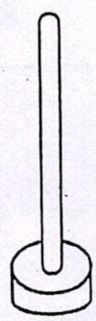


Pattern









Sieve

A sieve is used to remove foreign materials from the moulding sand. A sieve is a rectangular or circular frame with a wire mesh.

Rammer

A rammer is used to press or ram the moulding sand uniformly into the moulding box.

Strike-off Bar

A strike-off bar is a flat-edged rectangular bar made of wood. It is used to remove excess sand on top of the mould box after ramming.

Vent wire

A vent wire is a steel wire used to produce holes in sandfill after ramming. This enables the gases to escape out to the atmosphere when the molten metal is poured into the cavity of the mould.

Draw Spike

A draw spike is a steel spike with sharp pointed end. This is used to pick the pattern from the mould after ramming.

Mallet

A mallet is used to give light blow to the draw spike to drive it into the pattern in order to lift the pattern with the help of draw spike. It is round or rectangular and is made of hard wood.

Lifter

A lifter is used to remove the loose sand in the cavity produced in moulding. It is also used to finish the walls of the cavity after removing the pattern.

Trowel

A trowel is used to finish the cavity obtained in the mould. Trowels of various shapes and sizes are used in moulding process.

Sprue Pin or Runner

A sprue pin is a cylindrical and tapered wooden piece used to make a hole through which the molten metal is poured into the mould cavity.

Core

The core is used to make a hole or hollow casting. The core is normally made of core sand. The core sand can be removed easily after the casting. The core sand is having 90% silica sand and the remaining is binding materials (saw dust, asbestos, linseed oil, molasses etc.)

Shovel

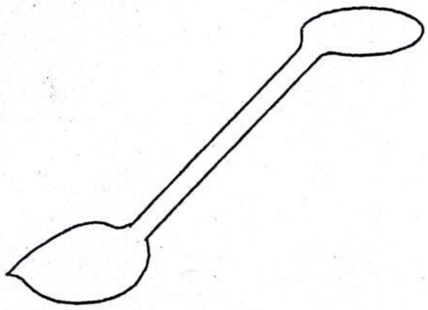
It is used to mix and move the mould sand from one place to another in the foundry shop. It consists of a broad iron pan fitted with a long wooden handle.

Bellow

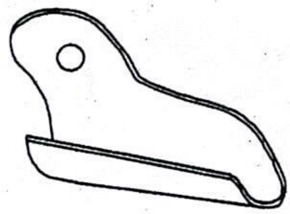
It is used to blow out sand particles and dust on the surface of the mould.

Swab

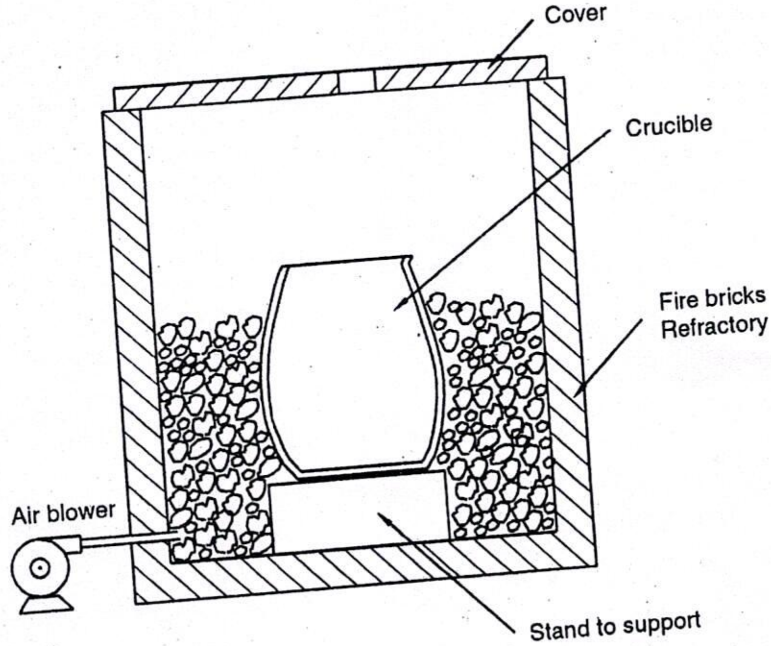
It is used to apply water on the edges of the pattern before removing it from the mould. It is easy to remove the moisturized pattern, otherwise mould sand sticks along with the pattern.



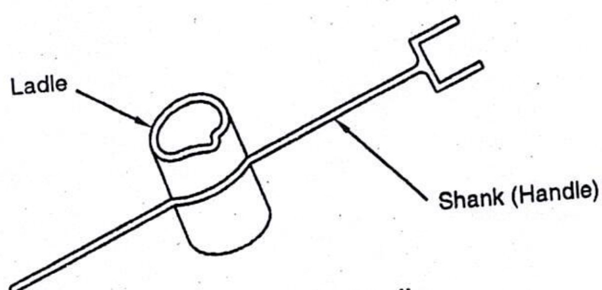
Slick



Gate cutter



Coke-fired crucible furnace



Shank ladle

50

Slick

It is used to repair and smoothen the mould surface after removing the pattern. It consists of a spoon shaped double ended trowel.

Gate Cutter

It is used to cut gates in the mould. The gate is connecting the runner hole and the mould cavity.

Melting Furnaces

The melting furnaces are used to melt the metal to be cast. Furnaces used to melt ferrous or non-ferrous metals are

(a) Coke-fired crucible furnace

(b) Oil-fired crucible furnace

(c) Gas-fired crucible furnace

(d) Cupola furnace

(e) Electric furnace etc.

Shank Ladle

The ladle is used to collect the molten metal from the crucible and pour it to the mould cavity.

EXPERIMENT– 08

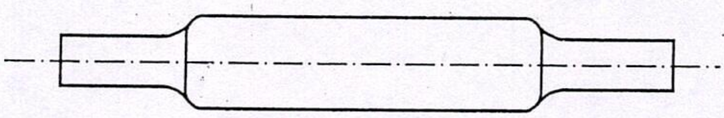
OBJECT: Design of pattern for a desired casting (containing hole).

EQUIPMENTS: Soft wood, scale, try square gauge, vernier calliper, scriber, divider etc.

THEORY:

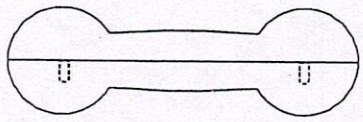
Types of Pattern

1. Solid or single piece pattern : A solid pattern is made in one piece without any joints. These are generally used for simpler shapes and low quantity production. Solid patterns are generally made of wood and are inexpensive. (see Fig. 1.1).



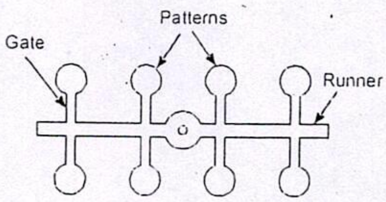
Solid pattern.

2. Split pattern : Many patterns cannot be made of a single piece because of the difficulty in moulding. To eliminate the difficulty the patterns are made split, half rests in lower part of the mould and half in upper part. (see Fig. 1.2).



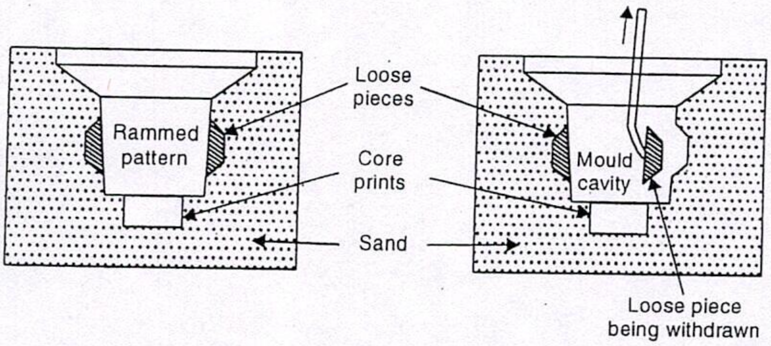
Split pattern.

3. Gated patterns : These are used in production work where many castings are required. Patterns are made of metal to give them strengths and to eliminate any warping tendency. The gates or runners for the molten metal are formed by connecting parts between the individual patterns. (see Fig. 1.3).



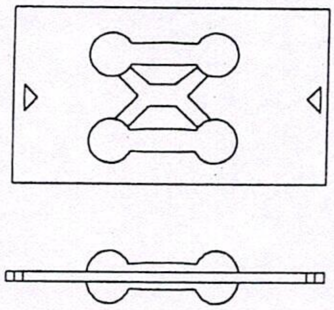
Gated pattern

4. Loose piece pattern : It consists of loose pieces, which are necessary to facilitate withdrawing it from the mould. (see Fig. 1.4).



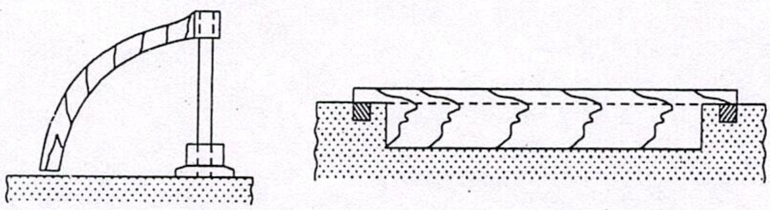
Loose piece pattern.

5. Match plates : These provide a substantial mounting for patterns. It consists of a flat metal or wooden plate to which the patterns and gate are permanently fastened. These are generally used for small castings with higher dimesional accuracy and mass production. (see Fig. 1.5).



Match plate pattern.

6. Sweep pattern : These are used where the shape to be moulded can be formed by the rotation of a curved line element about an axis. This type of pattern is generally suitable for very large castings such as bells for ornamental purposes. (see. Fig. 1.6).



Sweep pattern.

7. Skeleton pattern : These consist of a simple wood frame outlining the shape of the casting. This type of pattern is used for large castings, required in small numbers. (see Fig. 1.7).

Table Pattern, Finish Allowance, and Wall Thickness.

Metal	Pattern Oversize Factor (each direction)	Finish Allowance (smaller number for larger sizes)	Min Wall mm (inches)
Aluminum	1.08 – 1.12	0.5 to 1.0 %	4.75 (0.187)
Copper alloys	1.05 – 1.06	0.5 to 1.0 %	2.3 (0.094)
Gray Cast Iron	1.10	0.4 to 1.6 %	3.0 (0.125)
Nickel alloys	1.05	0.5 to 1.0 %	N/A
Steel	1.05 – 1.10	0.5 to 2%	5 (0.20)
Magnesium alloys	1.07 – 1.10	0.5 to 1.0 %	4.0 (0.157)
Malleable Irons	1.06 – 1.19	0.6 to 1.6 %	3.0 (0.125)

DESIGN OF PATTERN:

Some important design considerations are discussed below.

1. Pattern is slightly larger in size than casting.
2. Pattern is slightly tapered because it is given draft allowance of 1° for external and 3° for internal surfaces.
3. Pattern is provided with core prints to support the core to make hole in the casting.
4. Pattern may be made in two or three pieces whereas casting is a single piece.
5. The pattern elements for projecting details (bosses, lugs etc.) or undercuts should be made so that they do not hinder the removal of pattern from the mould.
6. Sharp corners are eliminated with a radius at the corner from one-half to one-third of the section thickness.
7. The pattern design should provide for easy removal of core materials and reinforcements.
8. Ribs should be rounded at edges and correctly filleted. Avoid complex ribs.
9. The pattern should be designed with uniform thickness.
10. A minimum wall thickness must be maintained to avoid voids and non-fill areas.

PRECAUTIONS:

1. All the dimensions should be taken carefully.
2. When uniform cross-sections cannot be maintained, then changes in cross-sections must be gradual.
3. Ensure proper pattern allowances while designing.

Pattern Allowances

A sand casting pattern is similar in shape to the cast product (but not exactly the same). A sand mould cavity is a negative replica of the pattern and is produced by packing sand around the pattern. When the pattern is prepared certain allowances are given on the sizes of casting. These are known as pattern allowances. The pattern allowances are discussed as follows :

1. **Shrinkage or Contraction allowance** : To compensate the solid phase contraction of the casting. The pattern dimensions are increased by a certain amount, depending on the cast metal and type of mould. It ranges from 13 mm/m for aluminum alloys, 16 mm/m for copper alloys and 20 mm/m for grey iron. Note that the casting shrinks away from the mould wall, implying that while external dimensions must be increased, internal dimensions (e.g. hole diameter) must be decreased.
2. **Machining or Finishing allowance** : It is provided on surfaces that are machined later. It involves adding material to pattern surface along the direction of its normal. The amount of addition depends on the dimensional tolerance achieved by the process, sub-surface quality, pattern size and the type of machining (manual or automatic). The allowance ranges from 1 mm for small aluminum die-cast parts to 20 mm or more for large grey iron sand cast parts.
3. **Draft or Taper allowance** : To facilitate the removal of the pattern form the weak, brittle moulding sand, the pattern should have some degree of taper, called draft. The amount of draft needed depends on the method of moulding and drawing of the pattern, the material the pattern is made from, the degree of precision, the surface smoothness of the pattern, and the type of moulding/casting process (manual or automatic). It ranges from 0.5° for small external faces close to parting line in automated die-casting machines, to 3° or more for large internal faces in manual moulding for sand casting process.
4. **Shaking or Rapping allowance** : When a removable pattern is rapped in the mould before it is withdrawn, the cavity in the mould increases slightly. In an average-size casting, this increase in size can be ignored. In large castings, or in ones that must fit together without machining, a shake allowance is occasionally considered by making the pattern slightly smaller.
5. **Distortion or Camber allowance** : Castings usually of irregular shape have a tendency to distort or warp during cooling. This is due to the uneven shrinkage of uneven metal thickness or due to one surface being more exposed than the other causing it to cool more rapidly. To allow for this the shape, the pattern is modified in such a way that it bends in opposite direction of the distortion. For example in a 'U' shaped casting, the legs are kept convergent so that on cooling the legs become parallel. The distortion allowance various from 2 mm to 20 mm depending upon the size of the casting.

The allowance can be combined in different ways to minimize the increase in casting volume (compared to the product volume). Example a vertical face far from the parting plane, for which ample draft has been applied, may require less machining allowance. Table 1.1 shows the pattern oversize factor, finish allowance and wall thickness for some common metals.

EXPERIMENT-09

OBJECT: Making a mould (with core) and casting.

EQUIPMENTS: Sand, cope and drag, core, molten metal, gating system, peen hammer, hand hammer, sprue pins, swab, trowels, shovel, vent wire, strike off bar, draw spike, gate cutter etc.

THEORY:

MOULDING SAND

Silica sand found in many natural deposits, is suited for moulding because it can withstand high temperature without breakdown. Sand is low in cost, has long life, and is available in a wide range of grain sizes and shapes. The disadvantages are that sand has a high expansion rate when subjected to heat and has a tendency to fuse with the metal.

Types of Moulding Sand

Foundary sands can be grouped as :

1. **Natural Sand** : It contains sufficient amount of binding clay and hence can be used directly.
2. **Synthetic Sand** : These are clay free high silica sand. Suitable binders are added to them to make them usable for foundry work.

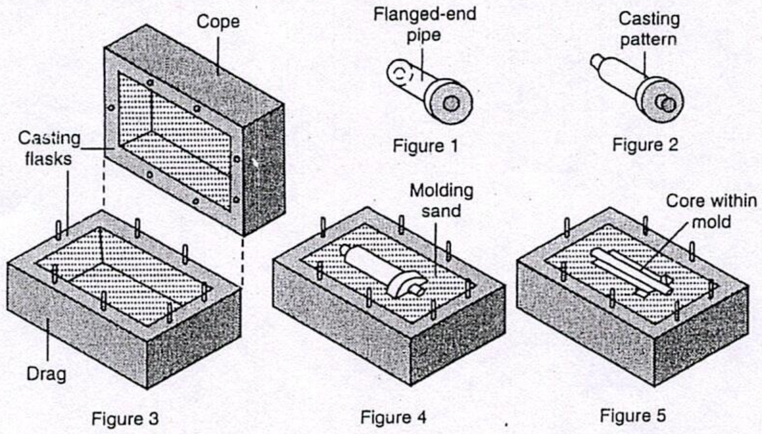
   Moulding sands can be further classified, according to its composition and use, into the following categories—

   1. **Green Sand** : Foundry sand containing moisture is known as green sand. It is a mixture of silica sand with 20 to 30% clay and water from 6 – 8%. Moulds prepared from green sand do not require any baking before pouring the molten metal into them.
   2. **Dry Sand** : It is the sand which is free from moisture and possess greater strength than green sand.
   3. **Facing Sand :** These forms the face of the mould *i.e.*, rammed around the pattern surface. It is the fresh prepared and well tempered foundry sand.
   4. **Parting Sand** : It is sprinkled on the pattern and the parting surfaces of the mould so that the sand mass of one flask does not stick to that of the other or to the pattern. Dry silica sand and 'burnt' sand are used for this purpose.
   5. **Floor or backing sand** : It is the sand which is left on the floor after the castings have been removed from the mould. It is used to back up the facing sand and to fill the rest of the flask.
   6. **Core Sand** : It is used for making cores and have a high silica content.
   7. **Oil Sand** : It is the silica sand using oil binders.

PROCEDURE:

Procedure for Making a Mould

Moulding a pattern and pouring a casting can be understood through a description of a simple casting such as a pipe as shown in Fig. 3.1 (Figure. 1-5), with a flanged end (Figure 1). The pattern for this casting is shown in Figure 2. The moulds for most castings are prepared in flasks (wooden boxes without top or bottom) equipped with pegs or other devices that enable the boxes to occupy the same relative position when fitted together (Figure 3). The lower box is called the drag, and the upper one the cope. In making the mould, the flat portion of half of the pattern is placed on a flat surface and the drag is invested and placed around it. Moulding sand is poured into the flask and rammed down until the entire flask is filled. The flask is then turned over and the other half of the pattern is set in place, as in Figure 4. A layer of special dry sand, called parting sand, is sprinkled on the surface of the flask; then the cope is placed in position, filled with sand, and rammed. The two halves of the mould are then taken apart and the pattern is drawn or removed. One or more gates or pouring holes are then pierced through the sand of the cope, as are smaller holes called risers that carry away part of the steam formed when the hot metal is poured into the mould.



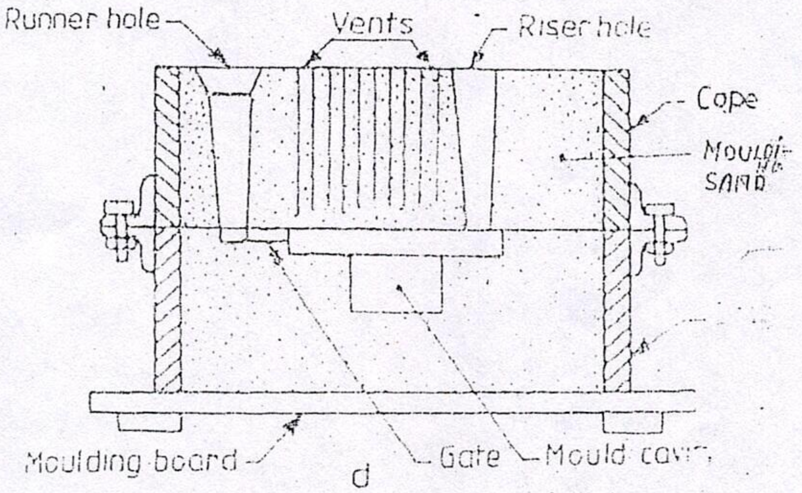
. Pipe Casting.

Finally, the core, the part of the mould that forms the hollow within the casting, is prepared. In the pipe shown in Figure 1, this core takes the form of a simple cylinder, but a complex casting may require one or more intricately shaped cores. The cores are formed in divided core boxes that serve as patterns. After forming they are baked in an oven until they are strong enough to be handled. The core is placed within the mould (Figure 5), and the other half of the mould is replaced. It is now ready for pouring. Having been melted in a furnace, the metal is hand-poured from a crucible for small castings or, in most cases, from a large dipper or bucket carried by a crane or special car until the mould is completely filled to the top of the gate.

After the casting has cooled within its mould, they both are shaken out of the flasks, and the mould is broken. The rods of metal formed in the gates and risers must be sawed off or otherwise removed.

PRECAUTIONS:

1. Proper ramming of sand should be done.
2. Molten metal should be handled with care.
3. Proper vents should be provided so that trapped gases can escape.
4. The mould prepared must be strong enough to hold the weight of the metal.
5. The mould must be referactory enough to withstand the high temperature of the molten metal and strip away cleanly from the casting after cooling.
6. Proper safety measures should be adopted.



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Mold for a solid flange

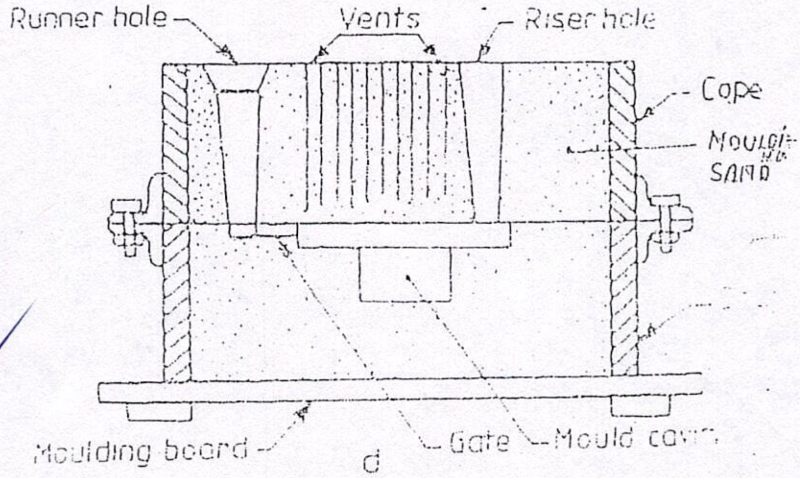
Ex-10

Object : To practice Non-ferrous metal lead casting.

Materials & Tools : Rammers, mallet, sprue pin, strike off bar, draw spike lifter, ·oother, gate cutter, vent wire, riser pin, moulding box, spirit level and molding sand. Pit nace, lead, coke, crucibles, ladle, etc.

ocedure :

1. First of all prepare a green moulding sand with the help of showel and mix them properly.
2. Flatten the moulding floor and check by spirit level.
3. Sparkle the parting sand on the floor.
4. Put the pattern on the flatten surface.
5. The drag part of moulding box is kept on the flatten surface and ensure that the pattern should be in centre.
6. Now the drag is filled with moulding sand and rammed it properly with the help of conical rammer and flat rammer.
7. The excess sand is remove by strike off bar to bring it in level with the edge of moulding box.
8. After sprinkle dry base sand on the top, the drag turned upside down.
9. Now, the cope is then placed aver the drag and sparkle parting sand over the entire surface and pattern.
10. Riser and runner are kept in the position and vertically supported by tucking a small amount of moulding sand around them.
11. Now, filled the cope with moulding sand and rammed it properly.
12. Remove the excess sand and remove the riser and runner carefully.
13. Make a pouring basin or cup on the place of riser pin.
14. Then after a bottom board is placed over the cope and rolled over.
15. Now remove the pattern part from drag portion with the help of draw spike.
16. Repair it, if required and cut the gate by gate cutter.
17. Make 6 to 8 holes on the core box around the mould with the help of vent wire.
18. Then apply dressing to make perfect mould.
19. Make runner from sprue pin to mould.
20. At last clean the mould & runner with the help of hand bellow and removed extra unwanted sands.
21. Now, mould is ready for pouring.
22. Now, place the mould at proper costing place.
23. Ready the pit furnace and start fire. Pit some hard coke on the furnace. When furnace is ready then crucible is placed with fire and fill more coke around the crucible with required raw lead.
24. Fill more coke around the crucible and start blower.
25. After sometime fire is moved properly and lead is melt.
26. Metal slag is removed by tilting of crucible.
27. Now, pour the molten metal (lead) in the mould and allow it for some time.
28. After solidification of molten metal, required casting is prepared.
29. Casting is taken out from mould after breaking them.



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Eshan College of Engineering Farah Mathura

CNC machine and automation

Practical No.

Objective

Study the constructional details of CNC lathe.

CNC Lathe:

CNC lathe machine is a simple lathe machine with CNC controls panel equipped with it. Internally all the functionality of cnc lathe machine it controlled through cnc control.Operated with Computer Numerical Control (CNC) systems and provided with precise design instructions, CNC Lathes are machine tools where the material or part is clamped and rotated by the main spindle, while the cutting tool that work on the material, is mounted and moved in various axis.

CNC Lathe Main Parts

1 – Headstock. 2 – CNC Lathe Bed

3 – Chuck. 4 – Tailstock

5 – Tailstock Quill. 6 – Foot Switch or Foot Pedals

7 – CNC Control Panel. 8 – Tool Turret

1 – Headstock

Headstock of a cnc lathe machine have the main motor of cnc lathe machine which drives the main spindle. Chuck is mounted on this main spindle.Here is another cnc lathe machine, the headstock covers are removed, so you can see the Main drive (Main Motor), Gears. Gears can be selected with the cnc programming instructions (M41,M42,M43)

2 – CNC Lathe Bed

The tool turret travel over the cnc lathe bed, which is specially hardened so any kind of machining can't affect them.

3 – Chuck

CNC lathe machine chuck grips the component which are to be machined. Chuck itself has many parts. Jaws are mounted on the chuck to grip the part, you might read more about jaws here CNC Machine Jaws an Introduction for CNC Lathe Machinist.

4 – Tailstock

Tailstock are mostly used to give an extra gripping force for component machining. For long components machining they provide extra force on the other end so machining process can complete smoothly. You can see in the above picture at the one end chuck is gripping the component and on the other end tailstock is providing the extra force.

5 – Tailstock Quill

Actually you move the whole tailstock forward or reverse, but in that way it is not used to grip the part, but tailstock is travelled to a point near the component and then it is set there, after that you actuate the tailstock quill which travel either with hydraulic pressure or pneumatic pressure to grip the component.

6 – Foot Switch or Foot Pedals

Foot switches are used to actual the chuck and tailstock quill. Through these pedals cnc machinist's open and close the chuck to grip the component, the same way tailstock quill is taken to forward position or reversed through theses pedals.

7 – CNC Control Panel

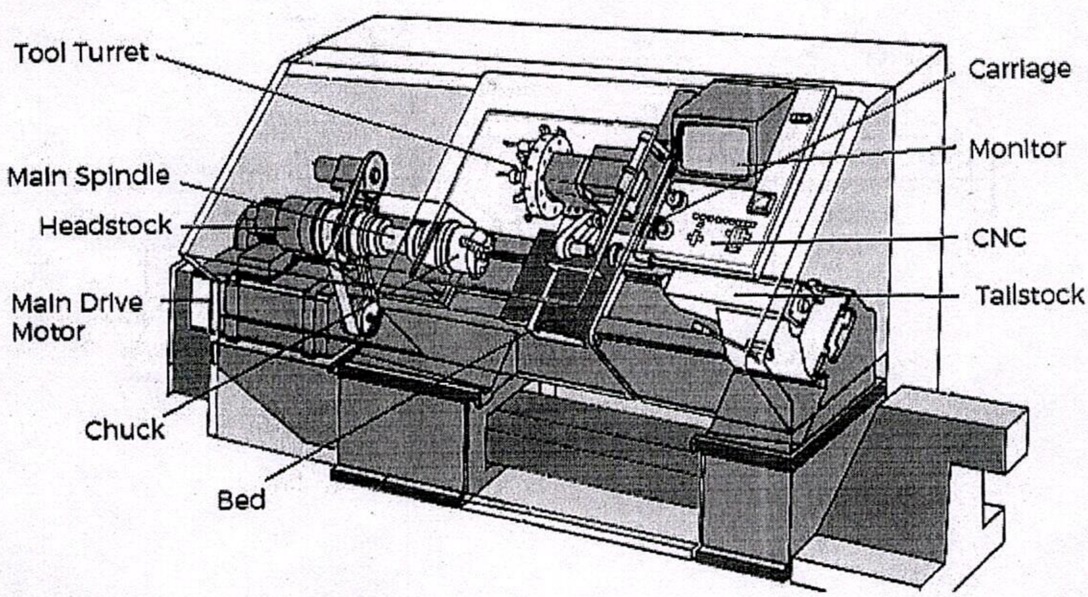
The brain of the cnc machine, all the cnc program are stored inside this panel, cnc machinists control the whole machine through the keys on this panel. CNC machinists stat/stop the machine move axis by pressing different keys on this panel.They can enter new program by using this panel, programs can be transferred by using usb port on this panel as well. So this is the main part which controls the whole cnc machine.

8 – Tool Turret

The tool are mounted on the tool turret which are used for component machining. Tool turrets vary in shapes and number of tools that can be mounted on them.

Other Complaint of CNC machine

- Central processing unit (CPU)
- Input devices
- Machine control panel
- Programmable logic controller (PLC)
- Servo-control unit
- Display unit



Diag. Main parts of a CNC lathe machine

Advantages of CNC Lathe

- CNC machines have the capacity to maintain the precision to a highest level.
- The process involved in CNC lathe machine operation is so simple.
- For working in repeated hours, CNC lathe is the most efficient mean.
- Basic drawing and programming skills will be enough to run the machine.
- Less man power is required for maintenance and machine operations

Experiment No.-5

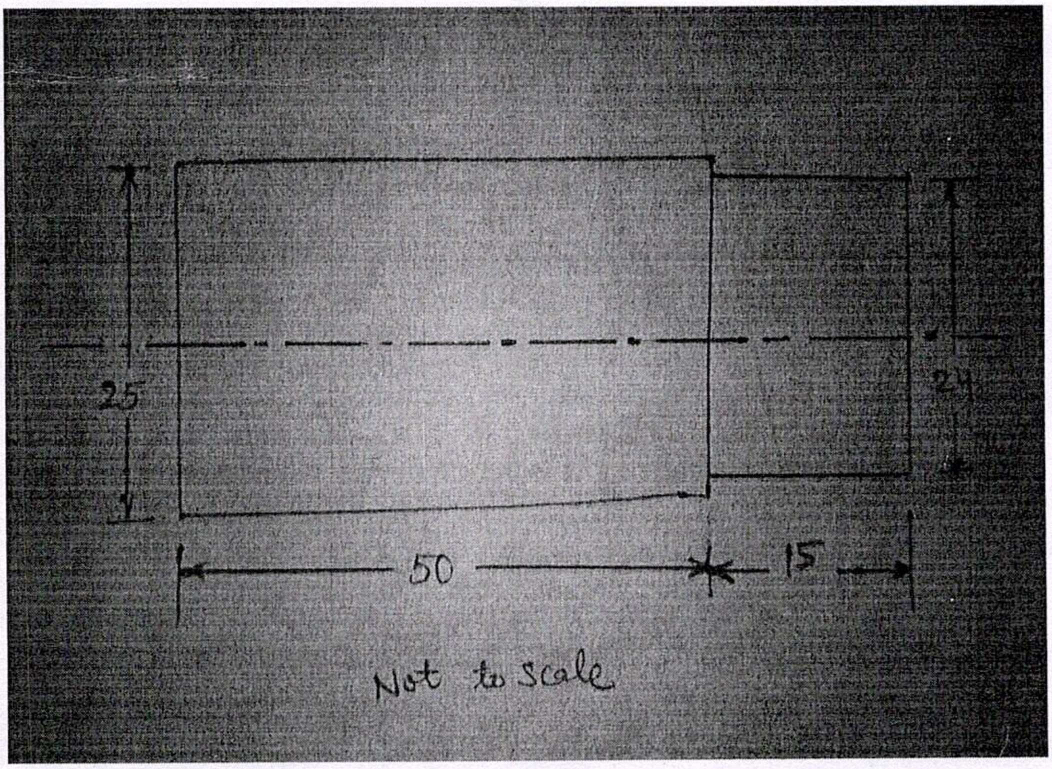
Object:

To prepare part program for plain turning operation.

Procedure:-

- Make part drawing (Taking suitable dimension).
- Prepare part program using G and M codes in cut viewer turn software.
- Run the program in simulation mode on PC.
- Observe the satisfactory machining of job on PC as per drawing/Sketch

Part Program:-



Program statement	Description
(TOOL/STANDARD, 40, 40, 0, 10, 3)	Turning tool description (Non-executable)
(STOCK/ 50, 25, 0, 0)	Stock description (Non-executable)
N10 M03 S2000	Spindle start clockwise with spindle 2000 RPM
N20 G00 X25 Z2	Rapid tool positioning (dia 25, length Z=2) up to reference point
N30 G01 X24	Linear interpolation up to X=24, with 1mm cut
N40 Z-15 F80	Up to length -15mm with feed rate 80mm/mint
N50 G00 X25 Z2	Rapid tool positioning up to reference point
N60 M30	Program End and Rewind

Result: - Part program of the given dimension has been prepared and also run on the software successfully.