DRONACHARYA
GROUP OF INSTITUTIONS

LABORATORY MANUAL

MANUFACTURING PROCESS LAB

SUBJECT CODE: KME-452

B.TECH. (ME) SEMESTER -IV

Academic Session: 2022-23, Even Semester

Student Name:	
Roll. No.:	
Branch/Section:	

Dronacharya Group of Institutions
Plot No. 27, Knowledge Park-3, Greater Noida, Uttar Pradesh 201308

Affiliated to

Dr. A P J Abdul Kalam Technical University
Lucknow, Uttar Pradesh 226031

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Vision and Mission of the Institute

Vision:

"Dronacharya Group of Institutions, Greater Noida aims to become an Institution of excellence in imparting quality Outcome Based Education that empowers the young generation with Knowledge, Skills, Research, Aptitude and Ethical values to solve Contemporary Challenging Problems"

Mission:

We, at Dronacharya Group of Institutions, are absolutely committed to serve the society and improve the mode of life by imparting high quality education in the field of Engineering and Management catering to the explicit needs of the students, society, humanity, and industry. 'Shiksha evam Sahayata' i.e. Education and help are the two words etched on our banner soaring higher year after year.

Vision and Mission of the Department

Vision:

"To become a Centre of Excellence in teaching and research in Mechanical Engineering for producing skilled professionals having a zeal to serve society"

Mission:

M1: To create an environment where students can be equipped with strong fundamental concepts.

M2: To provide an exposure to emerging technologies by providing hands on experience for generating competent professionals.

M3: To promote Research and Development in the frontier areas of Mechanical Engineering and encourage students for pursuing higher education

M4: To inculcate in students ethics, professional values, team work and leadership skills**.**

Program Educational Objectives (PEOs)

PEO 1. Engineers will practice the profession of engineering using a systems perspective and analyze, design, develop, optimize & implement engineering solutions and work productively as engineers, including supportive and leadership roles on multidisciplinary teams.

PEO 2. Continue their education in leading graduate programs in engineering & interdisciplinary areas to emerge as researchers, experts, educators & entrepreneurs and recognize the need for, and an ability to engage in continuing professional development and life-long learning.

PEO 3. Engineers, guided by the principles of sustainable development and global interconnectedness, will understand how engineering projects affect society and the environment.

PEO 4. Promote Design, Research, and implementation of products and services in the field of Engineering through Strong Communication and Entrepreneurial Skills.

PEO 5. Re-learn and innovate in ever-changing global economic and technological environments of the 21st century.

Program Outcomes (POs)

PO1: Engineering knowledge: Apply knowledge of mathematics, science, and engineering in Mechanical Engineering.

PO2: Problem analysis: Design and conduct experiments, as well as to analyze and interpret data.

PO3: Design/development of solutions: To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes.

Use the techniques, skills, and modern engineering tools necessary for engineering practice like AUTOCAD.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO 1: Graduates of the program will achieve excellence in product design, thermal engineering and manufacturing system by acquiring knowledge in mathematics, science and designing principles.

PSO 2: Graduate will be able to analyze, interpret and provide solutions to the real life mechanical engineering problems.

PSO 3: Graduate will develop an approach to solve multidisciplinary problems of manufacturing and allied industries.

University Syllabus

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.

2. Bolt (thread) making on Lathe machine.

3. Tool grinding (to provide tool angles) on tool-grinder machine.

4. Gear cutting on milling machine.

5. Machining a block on shaper machine.

6. Finishing of a surface on surface-grinding machine.

7. Drilling holes on drilling machine and study of twist-drill.

8. Study of different types of tools and its angles & materials.

9. Experiment on tool wear and tool life.

10. Experiment on jigs/Fixtures and its uses.

11. Gas welding experiment.

12. Arc welding experiment.

13. Resistance welding experiment.

14. Soldering & Brazing experiment.

15. Study and understanding of limits, fits & tolerances.

16. Study of temperature measuring equipment's.

17. Measurement using Strain gauge.

18. Experiment on dynamometers.

19. To study the displacement using LVDT.

Course Outcomes

CO 1	To understand the different conventional and unconventional manufacturing methods employed for making different products.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1		1		3			2	3	1	3	1
CO	**1**		**1**		**3**			**2**	**3**	**1**	**3**	**1**

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO 1	2		2
CO	**2**		**2**

Course Overview

1. To know about different metal cutting processes.
2. Study and Practice different welding processes.
3. To learn about tool wear.
4. Understand the working of dynamometer.
5. To learn the Processing of different materials.

List of Experiments mapped with COs

S. No	Aim of the Experiment	COs
1.	Gear cutting on Milling machine.	CO1
2.	Bolt (thread) making on Lathe machine.	CO1
3.	Arc welding experiment.	CO1
4.	Finishing of a surface on surface-grinding machine.	CO1
5.	Machining a block on shaper machine.	CO1
6.	Experiment on tool wear and tool life.	CO1
7.	Soldering & Brazing experiment.	CO1
8.	Drilling holes on drilling machine and study of twist-drill.	CO1

DOs and DON'Ts

DOs

1. Student must carry record and observation.
2. Take signature of lab in charge after completion of observation and record.
3. If any equipment fails in the experiment report it to the supervisor immediately.
4. Students should come to the lab with thorough theoretical knowledge.
5. Put your bags in the designated area.

DON'Ts

1. Don't touch the equipment without instructions from lab supervisor.
2. Don't crowd around the experiment and behave in-disciplinary.
3. Using the mobile phone in the laboratory is strictly prohibited.

General Safety Precautions

Precautions (In case of Injury or Electric Shock)

1. To break the victim with live electric source, use an insulator such as firewood or plastic to break the contact. Do not touch the victim with bare hands to avoid the risk of electrifying yourself.
2. Unplug the risk of faulty equipment. If the main circuit breaker is accessible, turn the circuit off.
3. If the victim is unconscious, start resuscitation immediately, use your hands to press the chest in and out to continue breathing function. Use mouth-to-mouth resuscitation if necessary.

Precautions (In case of Fire)

1. Turn the equipment off. If the power switch is not immediately accessible, take plug off.
2. If fire continues, try to curb the fire if possible, by using the fire extinguisher or by covering it with a heavy cloth if possible isolate the burning equipment from the other surrounding equipment.
3. Sound the fire alarm by activating the nearest alarm switch located in the hallway.

Guidelines to Students for Report Preparation

All students are required to maintain a record of the experiments conducted by them. Guidelines for its preparation are as follows:-

1) All files must contain a title page followed by an index page. ***The files will not be signed by the faculty without an entry in the index page.***

2) Student’s Name, Roll number and date of conduction of experiment must be written on all pages.

3) For each experiment, the record must contain the following

(i) Aim/Objective of the experiment

(ii) Pre-experiment work (as given by the faculty)

(iii) Lab assignment questions and their solutions

(iv) Test cases (if applicable to the course)

(v) Results/ output

Note:

1. Students must bring their lab record along with them whenever they come for the lab.

2. Students must ensure that their lab record is regularly evaluated.

Lab Assessment Criteria

An estimated 10 lab classes are conducted in a semester for each lab course. These lab classes are assessed continuously. Each lab experiment is evaluated based on 5 assessment criteria as shown in following table. Assessed performance in each experiment is used to compute CO attainment as well as internal marks in the lab course.

Grading Criteria	Exemplary (4)	Competent (3)	Needs Improvement (2)	Poor (1)
AC1: Pre-Lab written work (this may be assessed through viva)	Complete procedure with underlined concept is properly written	Underlined concept is written but procedure is incomplete	Not able to write concept and procedure	Underlined concept is not clearly understood
AC2: Program Writing/ Modeling	Assigned problem is properly analyzed, correct solution designed, appropriate language constructs/ tools are applied, Program/solution written is readable	Assigned problem is properly analyzed, correct solution designed, appropriate language constructs/ tools are applied	Assigned problem is properly analyzed & correct solution designed	Assigned problem is properly analyzed
AC3: Identification & Removal of errors/ bugs	Able to identify errors/ bugs and remove them	Able to identify errors/ bugs and remove them with little bit of guidance	Is dependent totally on someone for identification of errors/ bugs and their removal	Unable to understand the reason for errors/ bugs even after they are explicitly pointed out
AC4:Execution & Demonstration	All variants of input /output are tested, Solution is well demonstrated and implemented concept is clearly explained	All variants of input /output are not tested, However, solution is well demonstrated and implemented concept is clearly explained	Only few variants of input /output are tested, Solution is well demonstrated but implemented concept is not clearly explained	Solution is not well demonstrated and implemented concept is not clearly explained
AC5:Lab Record Assessment	All assigned problems are well recorded with objective, design constructs and solution along with Performance analysis using all variants of input and output	More than 70 % of the assigned problems are well recorded with objective, design contracts and solution along with Performance analysis is done with all variants of input and output	Less than 70 % of the assigned problems are well recorded with objective, design contracts and solution along with Performance analysis is done with all variants of input and output	Less than 40 % of the assigned problems are well recorded with objective, design contracts and solution along with Performance analysis is done with all variants of input and output

LAB EXPERIMENTS

EXPERIMENT NO.1

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

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

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

Main Components of milling machine:

Base, column, knee, saddle, table

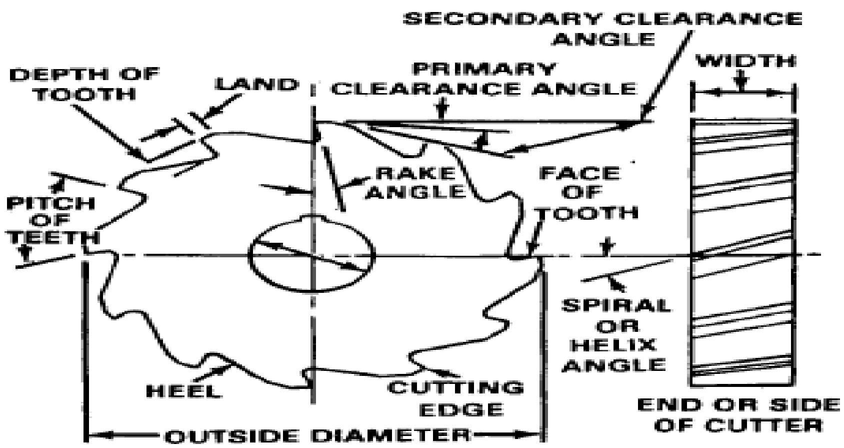
Type of milling machine:

Plain milling machine, vertical milling machine, universal milling machine, simplex milling machine, triplex milling machine

Type of Milling Cutter:

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

PROCEDURE:



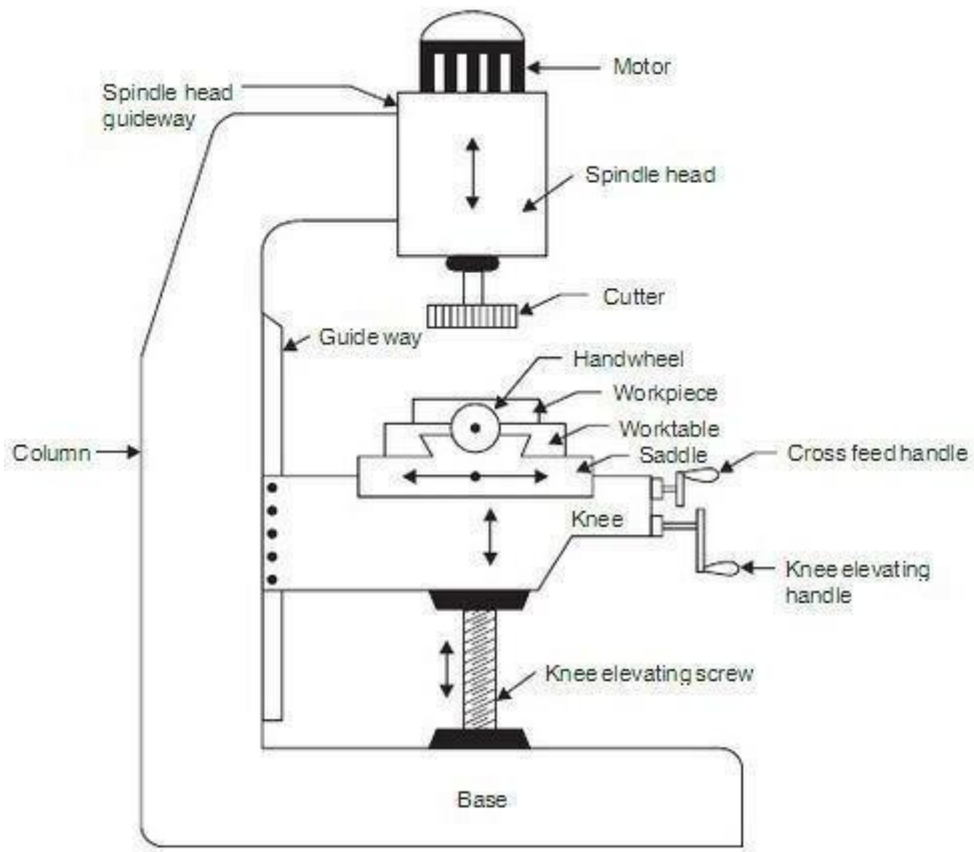


Fig. 4.10 Vertical milling machine

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

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

EXPERIMENT NO.2

OBJECTIVE: Bolt making on lathe machine

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

PROCEDURE:

1. Cut hexagonal material to length, with allowance for facing.
2. Face one end in the Centre Lathe to 90 mm length overall.
3. Centre Drill one end for the live center.
4. Hold the hexagonal bar in the 3 jaw chuck by around 5-8 mm withthe other end held by the live center.
5. Turn the 12 mm diameter for the thread x 80 mm long – measureWith the micrometer, size to finish at 12 mm minus 0.05 – 0.10.
6. Adjust the tool and clean up the corner for the head of the bolt.
7. Chamfer the 12 diameter end at 45 degrees x 2 mm.
8. Hold the 12 diameter in the chuck and chamfer the head at 45degrees.
9. Hold by the 12 diameter and start the thread using the Stock and Die. With the tailstock ensuring that the axis is square to the die – use cuttingcompound.
10. When sufficient has been cut to ensure the trueness of the thread,Take it out of the lathe and finish the tread depth to 60 mm in the metal working vice.

RESULT: Bolt by lathe machine has been prepared.

EXPERIMENT NO.3

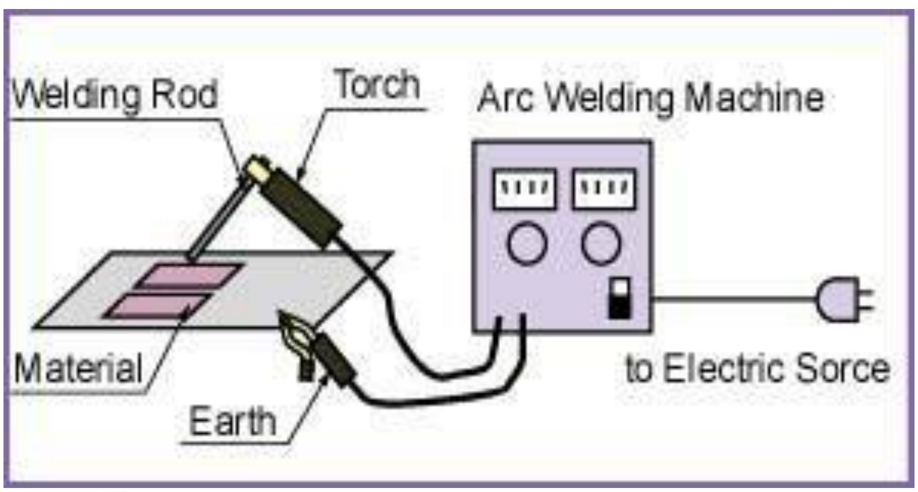
OBJECTIVE: Arc Welding experiment.

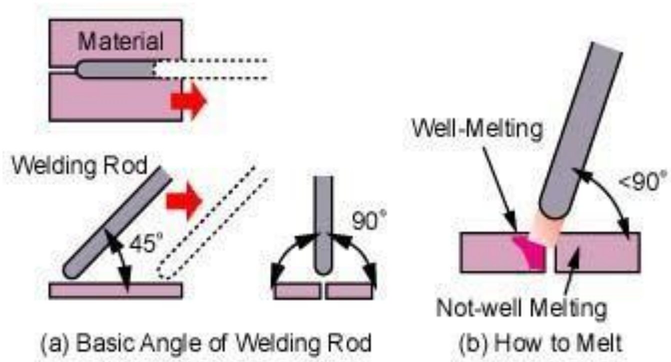
APPARATUS:

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

TYPE OF ARC WELDING: Gas metal arc welding (GMAW), Flux-cored arc welding (FCAW), Submerged arc welding (SAW), Gas tungsten arc welding (GTAW)

PROCEDURE:





Angles of Welding Rod

1. Clean the metal before welding
2. Set the joint
3. Strike a welding arc
4. Build up a weld pool

5. Start moving the weld pool across the metal
6. Finish the weld
7. Clean the slag
8. Examine the weld
9. Allow the metal to cool

RESULT: Arc welding experiment has been performed.

EXPERIMENT NO.4

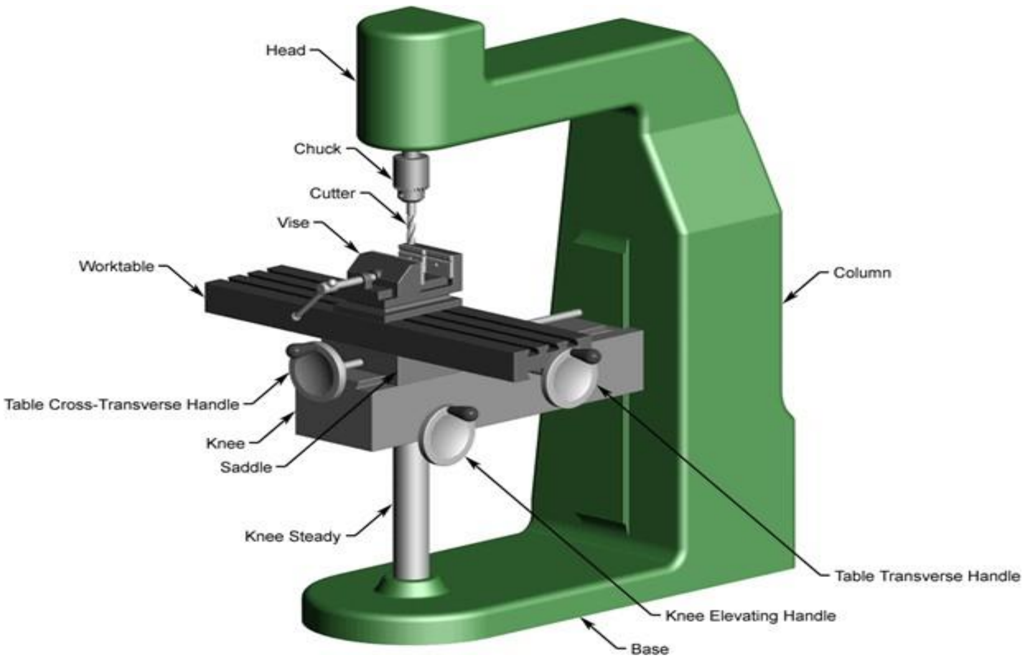
OBJECTIVE: Finishing of a surface on surface –grinding machine.

APPARATUS: Steel rule Try square, Vernier caliper

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

TYPES OF GRINDING MACHINES: Transverse grinding, Plunger grinding

PROCEDURE: (take square section)



1. The given work piece is taken and checked for its dimensions.
2. The job is placed on the grinding magnet at opened position.
3. Then each face is grinded to the required accuracy by constant speed.
4. The job is removed from the required accuracy. It is checked by using vernier caliper and squareness is checked by using try square.

RESULT: Thus the square section is grinded to the required accuracy in grindingmachine.

EXPERIMENT NO.5

OBJECTIVE: Machining a block on shaper machine.

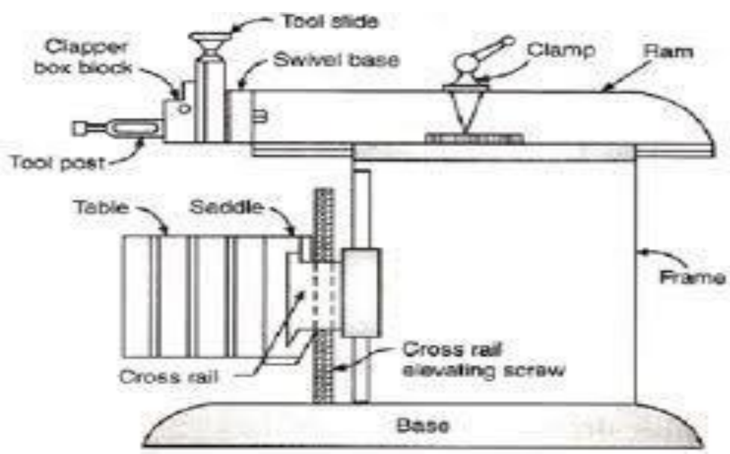
APPARATUS: Punching machine, Steel rule, Hammer, Shaper tool, Try Square

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

The principal parts of a standard shaper are:

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

PROCEDURE: (Square from round rod using Shaper)



1. The job was checked to the given dimensions.
2. The square was scribed in the outer circle of diameter of 50mm and Punchingwas done.
3. The job was attached in the vice of a shaper
4. The job was checked for perpendicular dimension.
5. Then the square from round was obtained in the shaper
6. The work piece was removed and burns are removed with accuracy waschecked.

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

EXPERIMENT NO.6

OBJECTIVE: Experiment on tool wear and tool life.

APPARATUS: milling machine, Drilling machine

THEORY:

Tool Life for milling Cutter

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

Taylor's tool life Equation

$$VT^n=C$$

V=Cutting speed, n=Cutting exponent, C= Cutting constant, T= tool lifen, C depends on speed, work material, tool material

Cutting speed can be obtained by:

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

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

PROCEDURE: Determine the cutting speed by using d&N values. Apply Taylor's equation and find tool life:

S.N.	n	C	d	N	V	T

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

Tool wear are classified as

1. Gradual Wear- Crater wear, Flank wear
2. Catastrophic wear- Braking, Chipping

Three basic mechanism involve in tool wear

1. Adhesive wear
2. Abrasive wear-Two body, three body
3. Diffusion wear

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

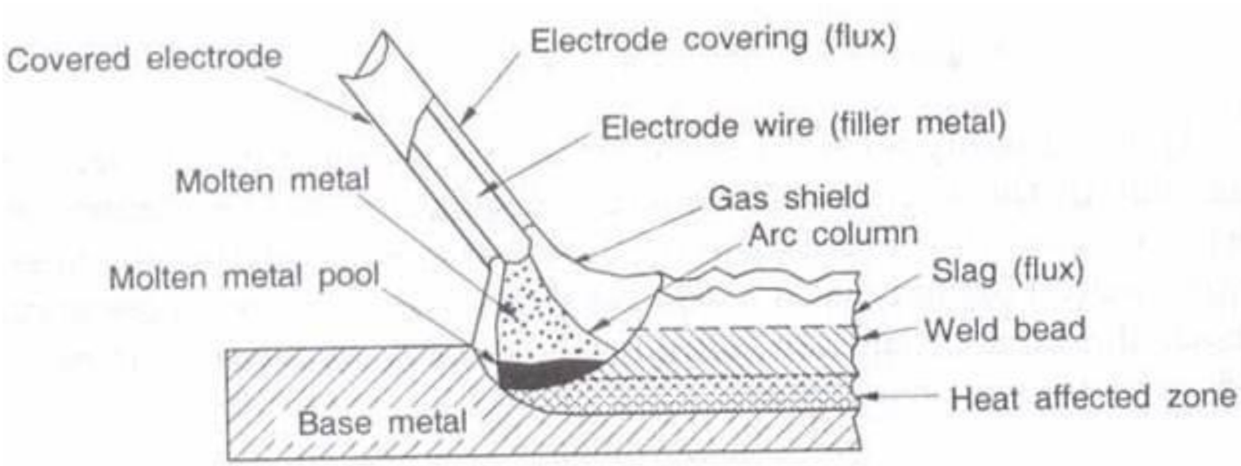
EXPERIMENT NO.7

OBJECTIVE: Soldering and Brazing Experiment.

APPARATUS: Soldering and brazing equipment

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

PROCEDURE:



SOLDERING:

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

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

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

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

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

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

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

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

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

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

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

12. Remove leftover flux with a commercial flux cleaner.

BRAZING:

1. Ensure fit and clearance
2. Clean metal
3. Flux prior to brazing
4. Fixturing of parts
5. Brazing the assembly
6. Cleaning the new joint

RESULT: Soldering and brazing experiment done.

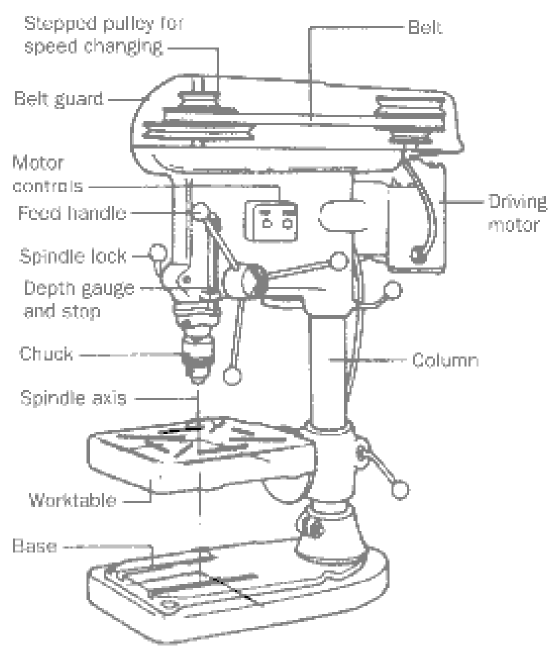
EXPERIMENT NO.8

OBJECTIVE: Drilling holes on drilling machine

APPARATUS: Drilling machine

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

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



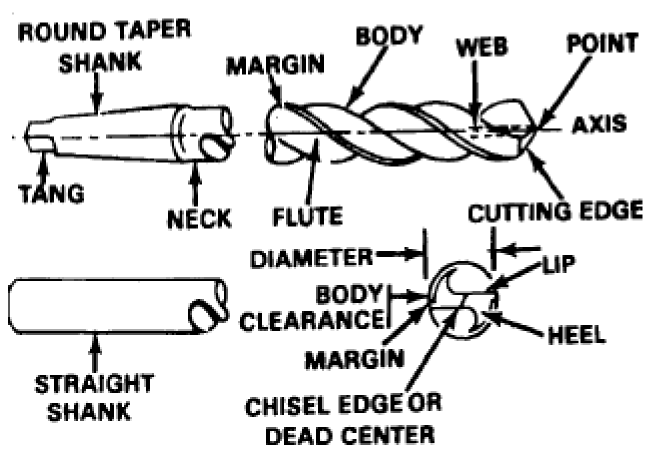
Tip: Over time, the guide hole in the wooden guide may become slightly enlarged, which may make it a bit more difficult to position the drill at exactly a 90 degree angle.

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

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

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

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



RESULT: Drilling operation has been performed.

Dr. Shailesh Kumar Singh

Lab IN-charge

Dr. Shailesh Kumar Singh

Head of Department (ME)

Prof. (Dr.) Seema Shukla

Director