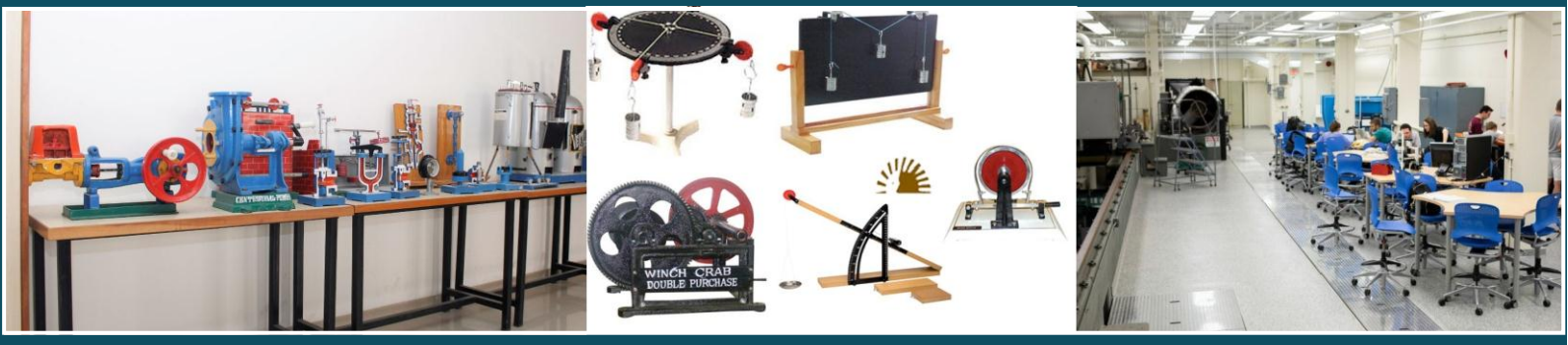
ARKA JAIN University
Jharkhand (Jamshedpur)

MECHANICAL ENGINEERING | SEMESTER – I | BACHELOR OF TECHNOLOGY

A LABORATORY MANUAL FOR WORKSHOP PRACTICE



ARKA JAIN University
Jharkhand (Jamshedpur)
Recognized by UGC

Subject: Workshop Practice Lab

Code: BTE22267

2 Credits | Semester II

Vision of the Institute

- ARKA JAIN University is committed to human development at all levels through education and entrepreneurship

Mission of the Institute

- To provide quality education thereby creating human assets.
- To fuel economic growth, create systemic changes, and sustainable improvements by developing new generation social entrepreneurs
- Create a globally networked community of leaders, technocrats, scientists, professionals, sports persons, and artists
- To foster an ethical environment founded on human values in which both spirit and skill thrives to enrich the quality of life

Vision of the Department

- To create competent and industry relevant Mechanical Engineers with professional and social values to meet global challenges.

Mission of the Department

The mission of the department is to produce graduates who will:

- Enabling environment for effective teaching – learning and research to meet global challenges.
- Motivating students to pursue higher education and to excel in competitive examinations and entrepreneurship.
- Establish a continuous Industry Institute Interaction to make the students employable.
- Inculcate the student's leadership quality with ethical values and spirit of team work.

CERTIFICATE

This is to certify that Mr./Ms.…….…….. Roll No. ……. of 1st Semester of B.TECH in Mechanical Engineering has completed the laboratory work satisfactorily in **Workshop Practice** for the academic year 20….. To 20…..as prescribed in the curriculum.

Name: ……..

Enrollment No:…….

Place: ……

Date: ……..

Lab In charge

Subject Teacher

Rules & Guidelines for conducting Lab-Work

- Students are not allowed, to do other activity in the laboratory area until you are instructed by Teacher or Technician.
- Before starting Laboratory work follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ask your Concern Teacher Before Proceeding with the Activity
- If you do not understand how to use a piece of equipment, ASK THE TEACHER FOR HELP!
- Perform only those experiments authorized by your teacher. Carefully follow all instructions, both written and oral.
- Unauthorized experiments are not allowed in the Laboratory.
- Students are not allowed to work in Laboratory alone or without presence of the teacher.

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Engineering knowledge: An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

[PO.2]. Problem analysis: Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

[PO.3]. Design/Development Of Solutions: Ability to design solutions for complex Engineering Problems by considering social, Economical and Environmental aspects.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge to design, conduct analyze experiments to get valid conclusion**.**

[PO.5]. Modern tool usage: ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Ability to apply knowledge by considering social health, safety, legal and cultural issues.

[PO.7]. Environment and sustainability: Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

[PO.8]. Ethics: Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

[PO.9]. Individual and teamwork: Ability to work effectively as an individual or in team, as a member or as a leader.

[PO.10]. Communication: An ability to communicate clearly and effectively through different modes of communication.

[PO.11]. Project management and finance: Ability to handle project and to manage finance related issue.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

PROGRAM SPECIFIC OUTCOMES

[PSO.1]. Engineering Drawing & Modeling: Use modern CAD tools and appropriate design standards to develop component and system drawings..

[PSO.2]. Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost..

[PSO.3]. Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools.

[PSO.4].Demonstrate& communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Program Specific Outcomes (PSOs):

After the successful completion of BTECH in Mechanical Engineering, the graduates will able to

PSO 1: Engineering Drawing &Modelling: Use modern CAD tools and appropriate design standards to develop component and system drawings.

PSO 2: Manufacturing: Apply the knowledge of manufacturing processes to develop a component with appropriate consideration for productivity, quality and cost.

PSO 3: Preventive Maintenance of Mechanical Systems: Demonstrate knowledge and understanding of the principles of preventive maintenance and apply those to develop schedule for machine tools.

PSO 4: Demonstrate & communicate: Ability to demonstrate the knowledge, skill to analyze the cause and effect on Mechanical Engineering.

Course Outcomes:

At the end of the course, students will be able to

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[CO1]Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines

[CO2] Understand job drawing and complete jobs as per specifications in allotted time
[CO3] Inspect the job for the desired dimensions and shape
[CO4] Operate, control different machines and equipment's adopting safety practices

Mapping course outcomes with program educational objectives:

Course Outcomes	Program Educational Objectives			
	PEO 1	PEO 2	PEO 3	PEO 4
1	✓	✓	✓	✓
2	✓			✓
3	✓			✓
4	✓			✓
5	✓			✓

Mapping course outcomes with the program outcomes:

Course Outcomes	Program Outcomes											
	A	B	C	D	E	F	G	H	I	J	K	L
1	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓		✓						✓
3	✓	✓		✓		✓						
4	✓	✓	✓	✓	✓	✓					✓	✓
5	✓	✓	✓			✓	✓					✓

Course Articulation Matrix: (Mapping of Cos with POs)

CO	STATEMENT	CORRELATIONWITHPROGRAM OUTCOMES										Correlation With Program Specific Outcomes	
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2

[CO1]	Acquire skills in basic engineering practice to identify, select and the various marking, measuring and holding, Sticking and cutting tools and equipment's and machines		**2**	**3**	**2**							**2**	**1**
[CO2]	Understand job drawing and complete jobs as per specification in allotted time.		**2**	**2**	**2**							**2**	**2**
[CO3]	Inspect the job for the desired dimension and shape		**2**	**3**	**2**							**3**	**2**
[CO4]	Operate, control different machines and equipment's adopting safety practice		**1**	**2**	**3**							**2**	**1**
[CO5]	Understand the sheet metal working and development of surfaces by sheet metal.		**2**	**2**	**2**							**2**	**2**

Criteria	**Description**	**Maximum Marks**

Assessment Plan:

Continuous Internal Assessment (CIA)	Internal Examination	5
	Attendance	5
	Assignment	5
End Semester Examination(ESE)	End Semester Examination	35
Total		50
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

Workshop Practice

Department of Mechanical Engineering

Subject: Workshop Practice Lab

Semester – Ist

INDEX

EXPERIMENT NO. 1

AIM:-To make a V- fitting from the given two M.S pieces.

TOOLS REQUIRED:-

1. Bench vice
2. Steel rule
3. Try square
4. Ball peen hammer

5. Scriber
6. Hack saw with blade
7. Dot punch and Centre punch
8. Surface plate
9. Vernier height gauge
10. Rough and smooth flat files
11. Flat chisel and triangular file

MATERIAL REQUIRED:-Mild steel (M.S) plate of size 48 x 34–2 Nos.

SEQUENCE OF OPERATIONS:-

1. Filing
2. Checking flatness and square ness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

PROCEDURE:-

1. The burrs in the pieces are removed and the dimensions are checked with a steel rule.
2. The pieces are clamped one after the other and the outer mating edges are filed by using rough and smooth files.
3. The flatness, straightness and square ness i.e. right angle between adjacent sides are checked with help of Try-square.
4. Chalk is then applied on the surfaces of the two pieces.
5. The given dimensions of the V-fitting are marked with help of vernier height gauge carefully.
6. Using the dot punch, dots are punched along the above scribed lines.
7. Using the hack saw, the unwanted portions are removed.
8. Using the flat chisel, the unwanted material in the piece Y is removed.
9. The cut edges are filed by the half round file.
10. The corners of the stepped surfaces are filed by using a square or triangular file to get the sharp corners.
11. The pieces (X and Y) are fitted together and the mating is checked for the correctness of the fit.

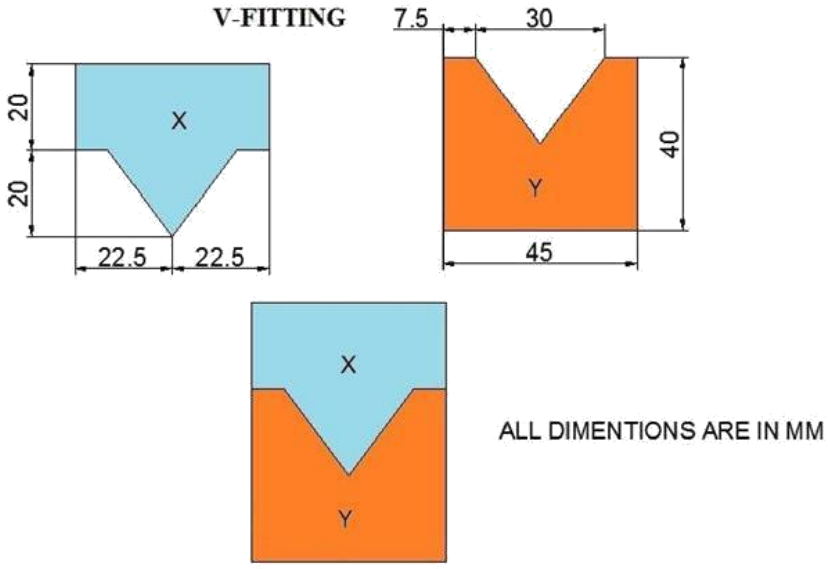


Fig 1.1 V- Fitting

SAFETY PRECAUTIONS:-

1. Care is taken to see that the marking dots are not crossed, which is indicated by the half of the punch dots left on the pieces.
2. Apply pressure in forward direction during hack sawing.
3. Don't rub steel rule on the job.
4. Fix blade in hack saw frame with correct tension.
5. During hack sawing the coolant like water or lubricating oil is to be used.
6. Use precision instruments like vernier calipers and vernier height gauge carefully.
7. Files are to be cleaned properly after using.

RESULT:-

V- Fit is made as per the required dimensions.

EXPERIMENT NO. 2

AIM:-To make a T- lap joint

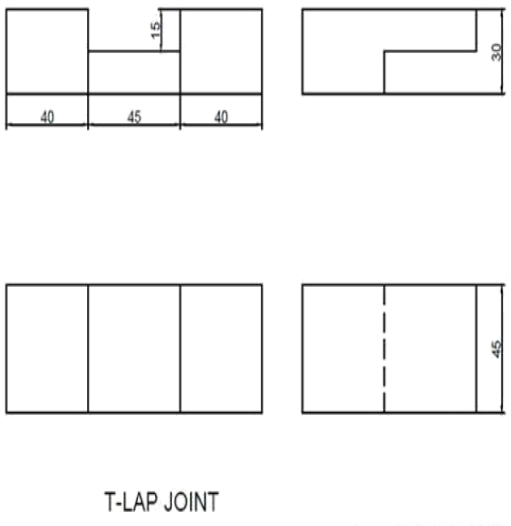
TOOLS REQUIRED:-

1. Carpenter's vice
2. Steel Rule
3. Try square
4. Jack plane
5. Scriber
6. Cross cut saw
7. Marking gauge
8. Firmer chisel
9. Mallet
10. Wood rasp file and smooth file

MATERIAL REQUIRED:-Wooden pieces of size 50 x 35 x 250 mm–2 Nos.

SEQUENCE OF OPERATIONS:-

1. Measuring and Marking
2. Planning
3. Check for squareness
4. Removal of extra material
5. Sawing
6. Chiseling
7. Finishing



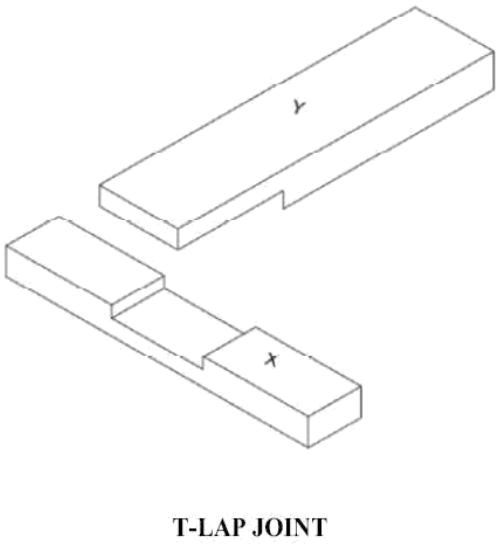


Fig 2.1 (a, b) T-Lap Joint

PROCEDURE:-

1. The given reaper is checked for dimensions.

2. They are planed with jack plane and checked for straightness.
3. The two surfaces are checked for squareness with a try square.
4. Marking gauge is set and lines are marked at 30 and 45 mm to mark the thickness and width of the model respectively.
5. The excess material is first chiseled with firmer and then planned to correct size.
6. The mating dimensions of the parts X and Y are then marked using steel rule and marking gauge.
7. Using the crosscut saw, the portions to be removed are cut in both the pieces, followed by chiseling.
8. The ends of both the parts are chiseled to the exact lengths.
9. The fine finishing is given to the parts, if required so that, proper fitting is obtained.
10. The parts are fitted to obtain a slightly tight joint.

SAFETY PRECAUTIONS:-

1. Loose cloths are to be avoided.
2. Tools to be placed at their proper placed.
3. Hands should not be placed in front of sharp edged tools.
4. Use only sharp tools.
5. Care should be taken, when thumb is used as a guide in cross cutting and ripping.
6. Handle while chiseling, sawing and planning with care.

RESULT:-

T- Lap joint is made as per the required dimensions.

EXPERIMENTNO-03

AIM: - To make a tray using the given G.I Sheet.

TOOLS REQUIRED: Steelrule**,** Scriber**,** Straightsnip**,** Benchvice**,** Stake**,** Crosspeenhammer**,** wooden mallet**,** Cuttingpier

MATERIALREQUIRED:-

Galvanized Iron(G.I) sheet 110x125 mm size

SEQUENCEOFOPERATIONS:-

- Cleaning
- Surfaceleveling
- Marking
- Cutting
- Folding

PROCEDURE:-

- Cleanthegivensheetwithcottonwaste.
- Thesizeofthegivensheetischeckedwiththesteelrule.
- Flattenthesurfaceofthegivensheetwithwoodenmallet.
- ChecktheG.I.Sheetfordimensionsand removeextramaterial, ifany.
- Markallthemeasuringlinesonthegivensheetwithscriber.
- Cutthegivensheetwithstraightsnips asrequired.
- Foldthegivensheetbyusingstakes andballpeen hammertotherequiredshape.
- Set5mmextra, allowanceonsidefaceforjoiningthecornersbyseaming.
- Notchthepointstopreventbulgingonseaming
- Cutthedevelopmentshapeonlinesbyusingpapercuttingsscissor
- Placeandfixthedevelopment ongivenG.PsheetbyusingSticker.
- Punchtwopointsoneachbendingline.
- MarktheboundarylinebyusingMarkingPen.

- Removethepaperdevelopmentjoint with twopunchpointsby ascribe ormarkingpen.
- Shearetheboundarylinesbyhandsnip.
- Flatteningthesheetbyusing mallet on flatter.
- Alwaysbendtheseaminglinefirstand remainingline staged thedesiredshapebyforming.
- Finishthesurfacekeepingonstaketoshape.
- Solderthejoint.
- FinishsurfacefinishingandcompletetheTray.

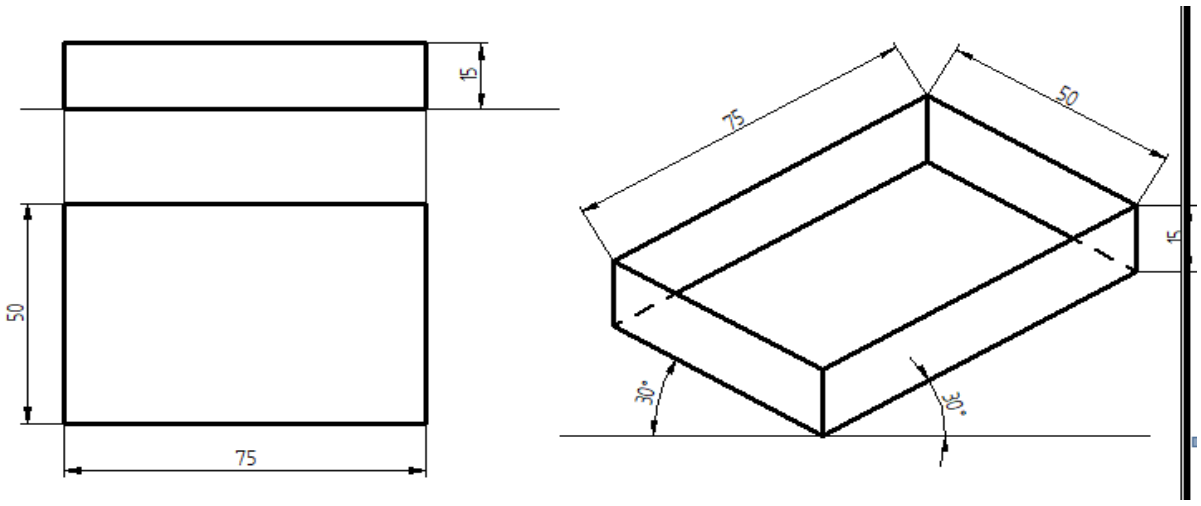


Fig. 3.1 (a)2D **(b)** 3D Drawing of tray

SAFETY PRECAUTIONS:-

1. Formarkingpurposeusescriberonly. Donotusepencilorpen.
2. Sufficientcareistobetakenwhilecutting andfolding ofG.I.sheet.
3. Removethewastepieces immediatelyfromtheworkplace.

RESULT:-Tray is prepared as per the required dimensions.

EXPERIMENTNO: 4

AIM:-To make a butt joint using the given two M.S pieces by arc welding.

MATERIALREQUIRED:-

Mildsteelplateofsize100X50X5mm–2 No's

WELDINGELECTRODES:-

M.Selectrodes3.1mm X350mm

WELDINGEQUIPMENT:-

Aircooledtransformer

Voltage-80to600 V3phasesupply,ampsupto350

TOOLSANDACCESSORIES REQUIRED: -Roughand smooth files, Protractor , Arcweldingmachine (transformer type), Mildsteelelectrodeandelectrode holder, Ground clamp, Tongs, Face shield, Apron, Chippinghammer.

SEQUENCEOFOPERATIONS:-

1. Marking
2. Cutting
3. Edgepreparation(Removalofrust,scaleetc.)byfilling
4. Trysquareleveling
5. Tacking
6. Welding
7. Cooling
8. Chipping
9. Cleaning

Procedure:

1. The given M.S pieces are thoroughly cleaned of rust and scale.
2. The two pieces are positioned on the welding table such that, the L shape is formed.

The tongs are made use of for the purpose.

3. Theelectrodeisfittedintheelectrodehold errand theweldingcurrentis set tobeapropervalue.
4. The ground clamp is fastened to the welding table.
5. Wearing the apron and using the face shield, the arc is struck and the work pieces are tack-welded at both the ends and at the center of the joint.
6. The alignment of the corner joint is checked and the tack-welded pieces are required.
7. The scale formation on the welds is removed by using the chipping hammer.
8. Filling is done to remove any spanner around the weld.

DRAWING:-

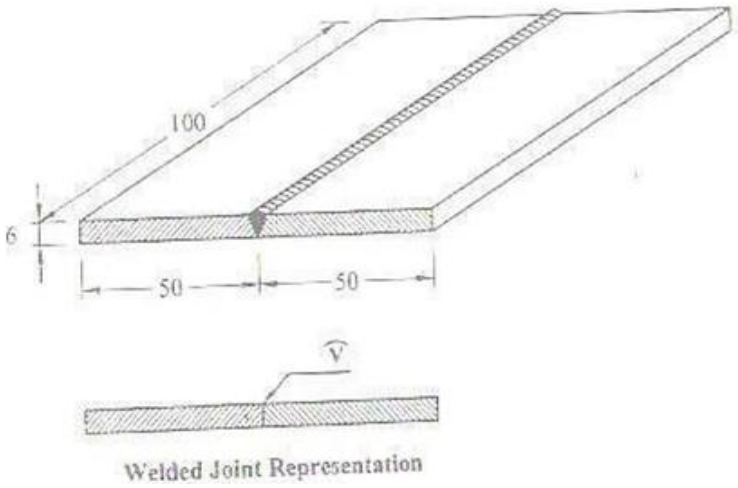


Fig. 4.1 Butt Joint

RESULT:-Weld joint prepared as per the required dimensions.

EXPERIMENT NO. 5

AIM: - To make the taper turning on cylindrical work piece as per the given drawing.

TOOLS REQUIRED: - Centre lathe machine**,** Lathe chuck,Vernier caliper,spct tools (DNMG/CNMG)**,** Revolving center,and Surface gauge

MATERIAL REQUIRED: -Mild steel (M.S) bar of size dia 50 x 100–1 Nos.

THEORY: Taper turning is a machining operation, which means that the diameter of a cylindrical work piece gradually decreases from one part to another. The taper can be external or internal. If the work piece is tapered on the outside, it has an external taper. If it is tapered on the inside, it has an internal taper.

SEQUENCE OF OPERATIONS:-

1. Marking & cutting
2. Clamping
3. Facing
4. Turning
5. Compound slide setting
6. De-clamping
7. Cleaning

PROCEDURE:-

1. To check the raw material size.
2. Hold the job in a 3 jaw chuck and true it keeping about 80mm outside chuck.
3. Set the tool to the correct center height.
4. Select and set the correct spindle rpm.
5. Face one side first and turn the outer diameter to 45 mm for the maximum possible length. Set the compound slide at proper angle.
6. Cut the taper with the feed of compound slide
7. Give the depth of cut with cross slide.
8. Remove the sharp edge.

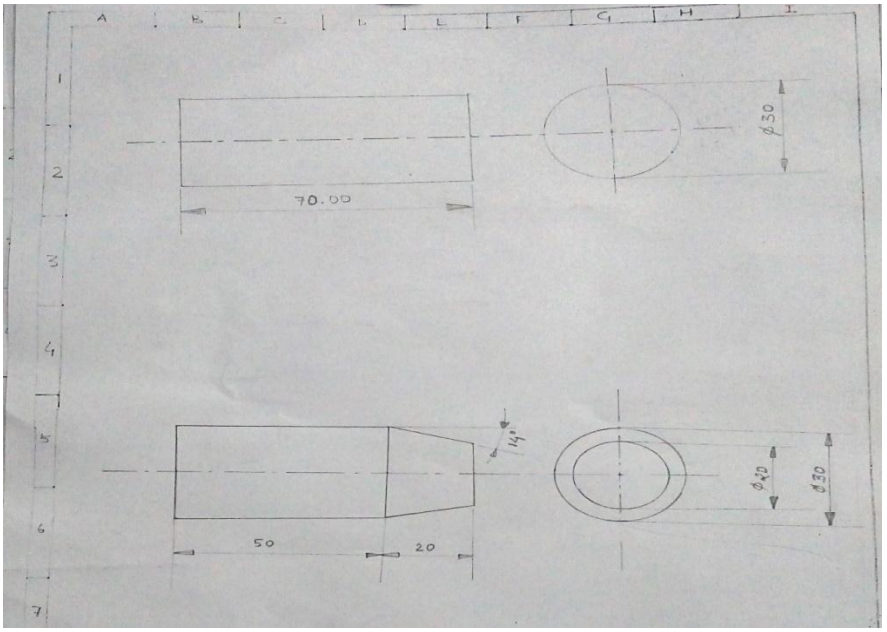


Fig: - 5.1 Tapper Turning

SAFETY PRECAUTIONS:-

1. Select proper spindle speed as per size and operation.
2. Feed slowly while turning and facing.
3. Use a coolant while turning and facing.
4. Remove all the sharp edges and check with the precision instruments.
5. Never operate a leaver when the machine in a motion.
6. Do not keep any tools on the moving parts of the machine.

RESULT:-

Achieve the required taper angle as per the drawing

EXPERIMENT NO. 6

AIM: - To make a matric thread M10 x 1.5 mm by using lathe machine.

TOOLS REQUIRED:-

SL NO	NAME OF THE TOOLS	SPECIFICATION	QUANTITY/RANGE
01	Drill bit	Ø8.5mm	1
02	Drill chuck	1-12 mm	1
03	Socket/sleeve	1-2 “	1
04	TAP	M10X1.5	1
05	TAP HANDLE	6”	1
06	CENTRE PUNCH	3”	1
07	CENTRAL DRILL	Ø8.0	1

MATERIAL REQUIRED:-

MS pieces of size dia. 12 x 150 mm–1Nos.

THEORY:

Thread cutting on the lathe is a process that produces a helical ridge of uniform section on the work piece. This is performed by taking successive cuts with a threading toolbit the same shape as the thread form required.

SEQUENCE OF OPERATIONS:-

1. Marking & cutting.
2. Clamping.
3. Facing.
4. Plain Turning.
5. Threading.
6. Finishing.
7. De-clamping.
8. Cleaning.

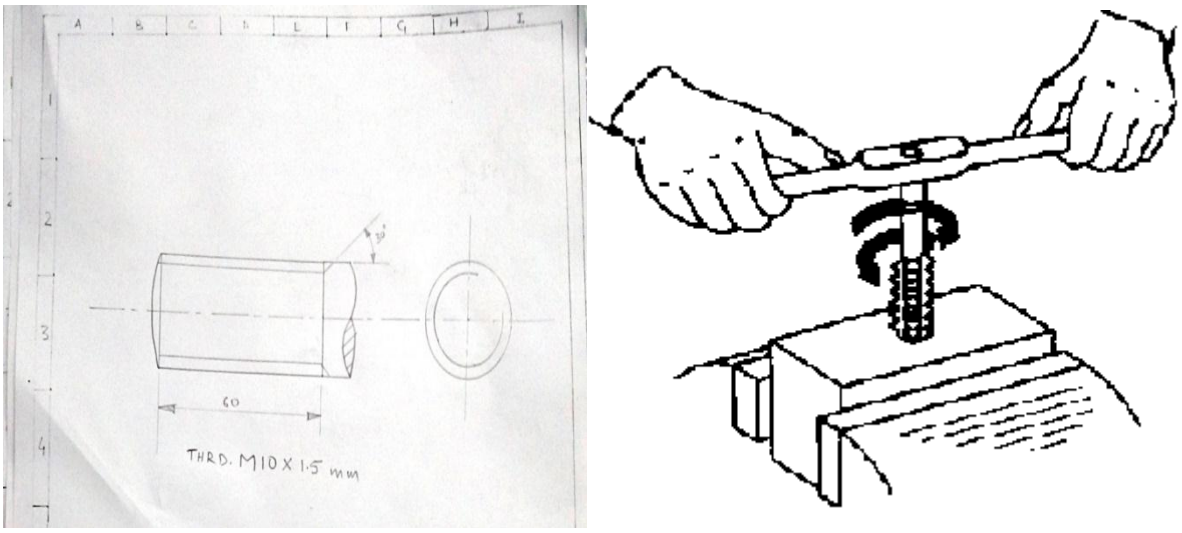


Fig 6.1:- Matric thread M10 x 1.5 drawing

PROCEDURE:-

1. To check the raw material size.
2. Hold the job in a 3 jaw chuck and true it keeping about 50mm outside chuck.
3. True the job with a surface gauge and face the end .
4. Set the tool to the correct center height.
5. Select and set the correct spindle rpm.
6. Face one side first and turn the outer diameter to 10 mm for the maximum possible length.
7. Reverse and hold the job.
8. Face the other end to a total length of 80 mm.
9. Turn dia. 10 mm to remaining length.
10. Set the angle in the compound rest for 45 degree.
11. Turn the taper by feeding the tool with the help of the top slide.
12. To hold the threading tool in the tool post and complete the threading operation.
13. Remove the sharp edge.

SAFETY PRECAUTIONS:-

1. Select proper spindle speed as per size and operation.
2. Feed slowly while turning and facing.
3. Use a coolant while turning and facing.

4. Deburr all the sharp edges and check with the precision instruments.
5. Never operate a leaver when the machine in a motion.
6. Do not keep any tools on the moving parts of the machine.

RESULT:-

Threading operation is done as per the required dimensions.

EXPERIMENT NO. 7

AIM: -Machining a V block on shaper machine.

APPARATUS REQUIRED:

1. Shaper machine
2. Shaper HSS tool
3. Handle
4. Try Square
5. Mallet

MATERIAL REQUIRED:-MS Block of size 50 x50 x 50 mm–1Nos.

THEORY:

The shaper is a reciprocating type of machine tool intended primarily to 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.

SEQUENCE OF OPERATIONS:-

1. Marking & cutting.
2. Clamping.
3. One face machining
4. Respected 90 degree faces are machined
5. Set the tool head at proper angle
6. Set the depth of cut .
7. Inclined machining.
8. Achieve the required angle and dimension.

PROCEDURE:

1. The job was checked before machining
2. Shaper tool is set to the tool holder
3. The job is clamped to the vice or table
4. Start the machine as per length of strok and get flat as per first face.
5. Change the another face of the square block for just perpendicular to the first face
6. To machine the second face and similarly machined the 3 rd face which is just perpendicular to the first and second face.

7. Marking the center line.
8. Set the tool head at proper angle
9. Set the depth of cut
10. Start the machining process at proper feed rate.
11. Achieve the required dimension as per the drawing.

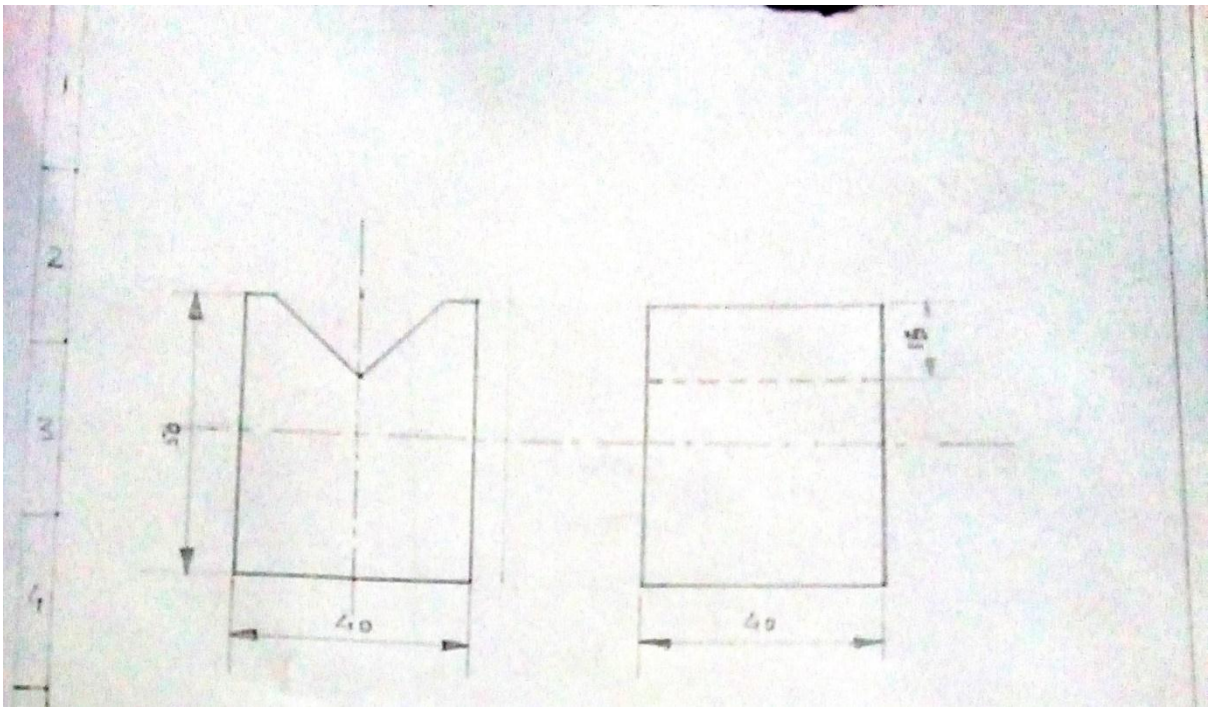


Fig 7.1 V block

PRECAUTIONS:-

1. Electric connection must be checked prior to the operation of machine
2. Choose proper feed and depth of cut.
3. Feed should be controlle4d to avoid to any damage to the cutting tool.
4. Fix the work piece is properly into the vice.
5. During cutting to supply coolant in between to the work piece and tool.
6. Adjust the stroke length properly.

CONCLUSION:-

Thus the V- block was made using a shaper machine with the required dimensions.

Experiment No. 8

AIM: - To make a step turning operation on cylindrical M.S. work piece using lathe machine.

RAW MATERIAL REQUIRED:-MS ROD of diameter 30mm and length 100mm.

TOOLS AND INSTRUMENT REQUIRED:-

SL NO	NAME OF THE APPARATUS	SPECIFICATION	QUANTITY
01	Single point cutting tool (HSS)	4”	1
02	Revolving center	Dead center	1
03	spanner	10-11 mm	1
04	Lathe	Capstan turret Lathe	1
05	Chuck key	4”	1
06	Venire caliper	0-150mm	1
07	Surface gauge	Magnetic type	1

SEQUENCE OF OPERATION

1. Cutting
2. Clamping
3. Tool setting
4. Cantering
5. R.p.m. setting
6. Facing
7. Turning
8. Decamping
9. cleaning

PROCEDURE: -

1. At first the work piece is fitted properly on the lathe chuck by the help of a surface gauge & chuck key.
2. The center of the work piece is located by the help of tail stock.
3. Hold the cutting tool at the tool post.
4. Set the appropriate r.p.m. of the spindle.
5. Now we run the lathe machine by making power switch on
6. At first the facing the work piece then a single cut the required length.
7. Achieve the greater diameter as per drawing .and required length.
8. De-clamp the work piece safely.

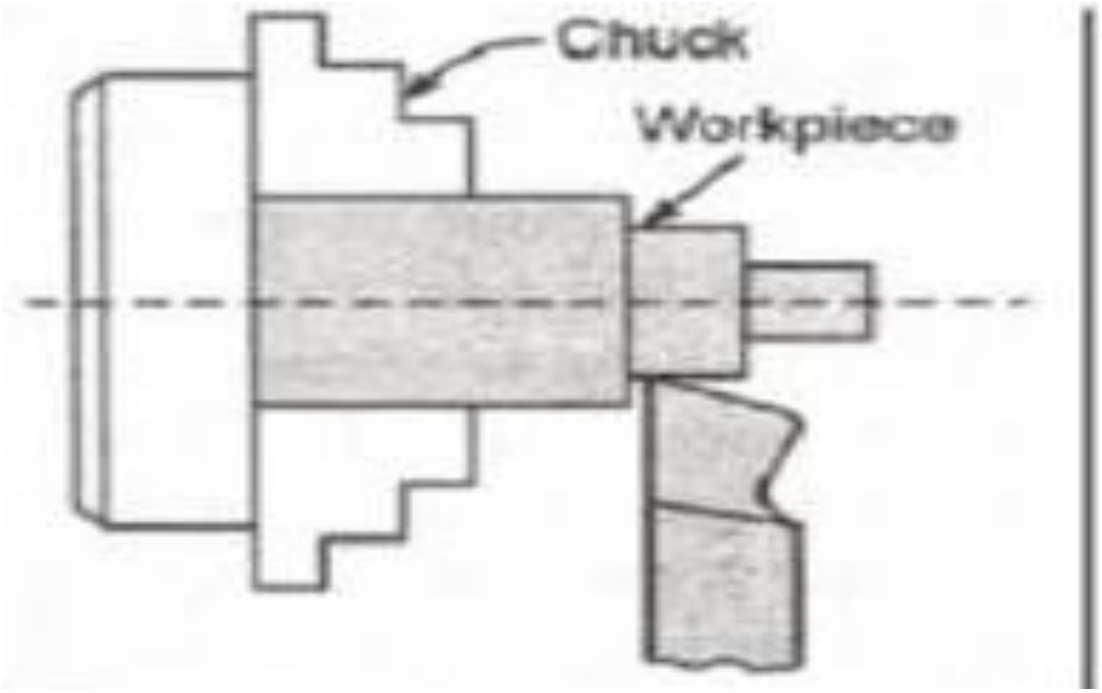


Figure: - 8.1 Step Turning

SAFETY AND PRECATIONS:-

- Clamp the job tritely
- Clamp the tool tritely
- Maintain the distance at the running spindle.
- Do not wear the loose cloths.
- Be careful for running spindle.
- Do not talking during operation on lathe machine.