PRODUCTION ENGINEERING – II

LABORATORY MANUAL

MECHANICAL ENGINEERING DEPARTMENT

(ISO 9001:2008 Certified)

MES COLLEGE OF ENGINEERING, KUTTIPPURAM

Production Engineering –II Laboratory Manual

MECHANICAL ENGINEERING DEPARTMENT

Revision	Date	Prepared by			Approved by		
		Name	Designation	Signature	Name	Designation	Signature
Rev1.0					Dr.Rahmathunza. I	Prof. & HoD ME Dept.	

VISION

To develop the Department into a premier destination of international level for advanced learning in Mechanical Engineering and to mould quality engineers to serve the society through creative solutions.

MISSION

- To mould engineers who would be able to apply the basic science and mathematics with confidence in professional activities for the benefit of all.
- To make our graduates experts in practical problem solving with abstract thinking skills.
- To make our students life-long learners capable of building their careers upon a solid foundation of knowledge and competent in communicating technical materials and concepts in individual group situations

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After 3-4 years of graduation, our students will be able to

- Demonstrate their skills in technical profession and/or higher education by using the acquired knowledge in Mathematics, Science and Engineering fundamentals.
- Analyze the real life problems and propose sustainable design solutions for specific needs through applications of Engineering principles.
- Recognize the ethical responsibility as engineers and judiciously serve their peers, employers & society for the benefit of all.
- Practice life-long learning by continuing up gradation of possessed skills.

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the end of four year programme the students (graduates) will be able to:

- Demonstrate basic knowledge in mathematics, science and engineering.
- Design, manufacture and analyze a Mechanical system using modern engineering software tools and measurement systems.
- Cognize concepts involved in thermal and fluid energy systems.
- Utilize self education to develop lifelong learning to appraise and adapt global and societal contexts to propose Engineering solutions.

<u>PROGRAM OUTCOMES (POs)</u>

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analy**sis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.

11. **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.
12. **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.

TABLE OF CONTENTS

Course Outcomes (CO’s)

Course Outcomes (COs)

ME09 408(P): PRODUCTION ENGINEERING LAB – II (C216)	
C216.1	Able to explain the working of shaper, slotting, milling and grinding machines
C216.2	Able to model using basic machining operations on shaper, slotting, milling and grinding machines.

ME14 508(P): PRODUCTION ENGINEERING LAB – II (C308)	
C308.1	Able to explain the working of shaper, slotting, milling and grinding machines
C308.2	Able to model using basic machining operations on shaper, slotting, milling and grinding machines.

MODEL NO:1

SHAPER . CUBE

AIM

To make a cube using shaping machine.

MATERIALS REQUIRED

Cast Iron cube of size 50 mm

TOOLS REQUIRED

1. “V” nose tool
2. Square nose tool
3. Vernier Height Gauge
4. Centre punch
5. Ball peen hammer.
6. Try square.

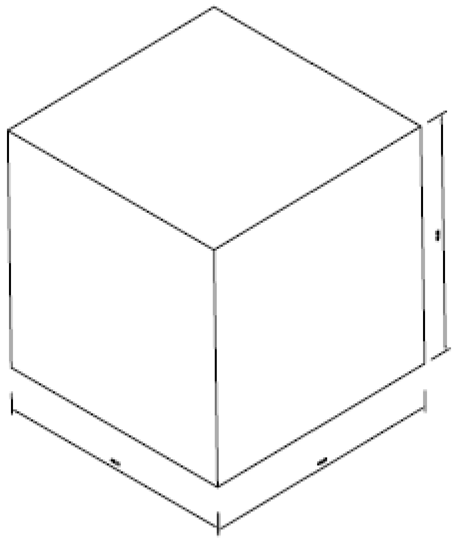
PROCEDURE

1. Copy the drawing.
2. Fix the tool and work piece in position.
3. Adjust the stroke length properly.
4. Machining surfaces to obtain the required shape.
5. Finished the model by finishing tool.. Checked the dimensions and found correct.

RESULT

Cube with given dimension is obtained as per the given drawing keeping the tolerance +_ 0.1mm.

SHAPER MODEL NO:1



CUBE

TOLERANCE ± 0.10 mm

SCALE 1:1

ALL DIMENSIONS ARE IN mm

MODEL NO:2

SHAPER . KEY WAY

AIM

To make a Key way on the given Cast Iron Cube using shaping machine.

MATERIALS REQUIRED

Cast Iron cube of size 50 mm

TOOLS REQUIRED

1. “V” nose tool
2. Square nose tool
3. Vernier Height Gauge
4. Centre punch
5. Ball peen hammer.
6. Try square.

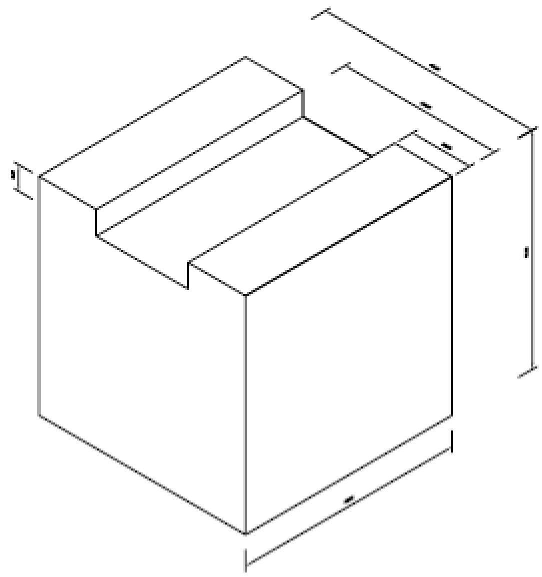
PROCEDURE

1. Copy the drawing.
2. Fix the tool and work piece in position.
3. Adjust the stroke length properly.
4. Machining surfaces to obtain the required shape and dimensions of cube.
5. Machining key way roughly with “v” nose tool.
6. Finish the key way with square nose tool.
5. Checked the dimensions and found correct.

RESULT

Cube with given dimension and key way is obtained as per the given drawing keeping the tolerance +_ 0.1mm.

SHAPER MODEL NO:2



KEY WAY

TOLERANCE ± 0.10 mm

SCALE 1:1

ALL DIMENSIONS ARE IN mm

MODEL NO:3

SHAPER . V-GROOVE

AIM

To make a V-Groove on the given Cast Iron Cube using shaping machine.

MATERIALS REQUIRED

Cast Iron cube of size 50 mm

TOOLS REQUIRED

1. “V” nose tool
2. Square nose tool
3. Vernier Height Gauge
4. Centre punch
5. Ball peen hammer.
6. Try square.

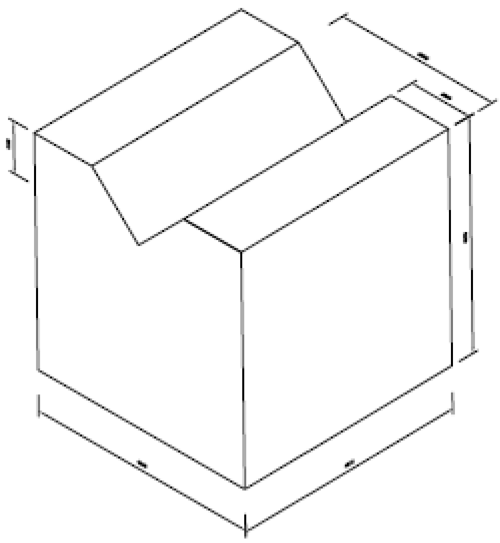
PROCEDURE

1. Copy the drawing.
2. Fix the tool and work piece in position.
3. Adjust the stroke length properly.
4. Machining surfaces to obtain the required shape and dimensions of cube.
5. Marked the dimensions of the V-groove and punched.
6. Finish one side of the V-groove by rotating the ram head to half angle of “V” to one side and finish that side.
7. Rotate the ram head to the opposite side to the same angle and finish the other side of “V”.
8. Checked the dimensions and found correct.

RESULT

Cube with given dimension and “V”-groove is obtained as per the given drawing keeping the tolerance +_ 0.1mm.

SHAPER MODEL NO:3



' V ' GROOVE

TOLERANCE ± 0.10 mm

SCALE 1:1

ALL DIMENSIONS ARE IN mm

MODEL NO:4

SLOTTING MACHINE . CUBE

AIM

To make a Cube on the given Cast Iron block using slotting machine.

MATERIALS REQUIRED

Cast Iron cube of size 50 mm

TOOLS REQUIRED

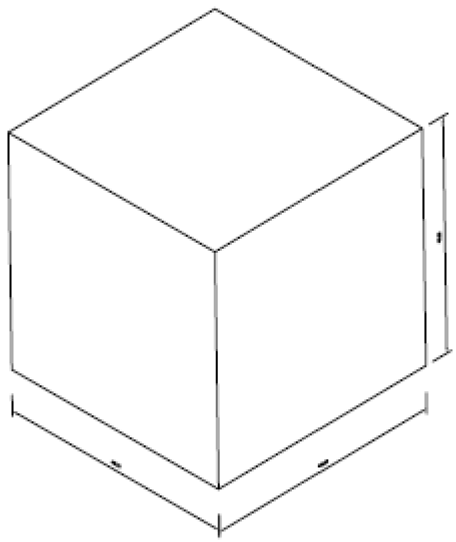
1. “V” nose tool
2. Square nose tool
3. Vernier Height Gauge
4. Centre punch
5. Ball peen hammer.
6. Try square.

PROCEDURE

1. Copy the drawing.
2. Fix the tool and work piece in position.
3. Adjust the stroke length properly.
4. Machining surfaces to obtain the required shape and dimensions of cube.
5. Checked the dimensions and found correct.

RESULT

Cube with given dimension is obtained as per the given drawing keeping the tolerance +_ 0.1mm.



CUBE

TOLERANCE ± 0.10 mm

SCALE 1:1

ALL DIMENSIONS ARE IN mm

MODEL NO:5

SLOTTING MACHINE . KEY WAY

AIM

To cut a key way on the given Cast Iron block using slotting machine.

MATERIALS REQUIRED

Cast Iron cube of size 50 mm

TOOLS REQUIRED

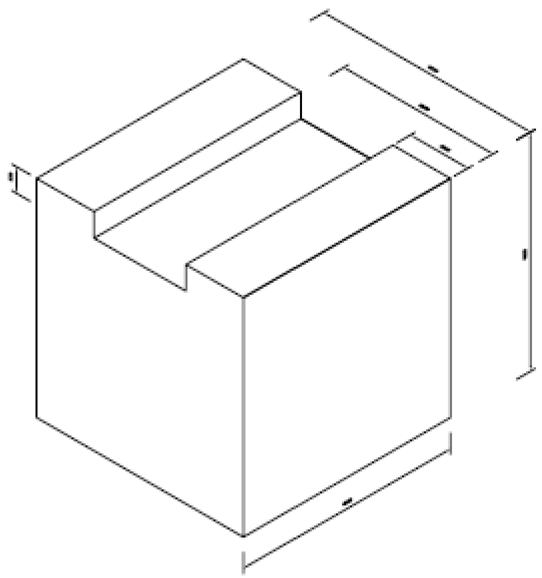
1. “V” nose tool
2. Square nose tool
3. Vernier Height Gauge
4. Centre punch
5. Ball peen hammer.
6. Try square.

PROCEDURE

1. Copy the drawing.
2. Fix the tool and work piece in position.
3. Adjust the stroke length properly.
4. Machining surfaces to obtain the required shape and dimensions of cube.
5. Mark the dimensions of the key way on the work and punch it.
6. Machining the key way roughly by using a single point tool.
7. Finish the key way using parting tool.
8. Checked the dimensions and found correct.

RESULT

Cube with given dimension and key way is obtained as per the given drawing keeping the tolerance +_ 0.1mm.



KEY WAY

TOLERANCE ± 0-10 MM

SCALE 1:1

ALL DIMENSIONS ARE IN MM

MODEL NO:6

SLOTTING MACHINE- FILLET

AIM

To cut a fillet on the given Cast Iron block using slotting machine.

MATERIALS REQUIRED

Cast Iron cube of size 50 mm

TOOLS REQUIRED

1. “V” nose tool
2. Square nose tool
3. Vernier Height Gauge
4. Centre punch
5. Ball peen hammer.
6. Try square.

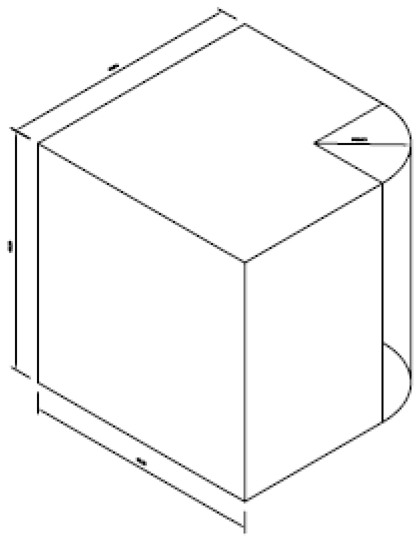
PROCEDURE

1. Copy the drawing.
2. Fix the tool and work piece in position.
3. Adjust the stroke length properly.
4. Machining surfaces to obtain the required shape and dimensions of cube.
5. Mark the radius of the fillet on the edge of the cubeas given in the figure and punch it.
6. The centre radius point of the fillet was made to coincide with the centre of the rotary table by coinciding the cutting tool point with the centre of the rotary table and then with the centre of the fillet.
7. After coinciding the centers, the work piece was clamped on the table.
8. Cut fillet on the work piece by rotating the table.

9. Checked the dimensions and found correct.

RESULT

Cube with given dimension and fillet is obtained as per the given drawing keeping the tolerance +_ 0.1mm.



FILLET

TOLERANCE ± 0.10 MM

SCALE 1:1

ALL DIMENSIONS ARE IN MM

MODEL NO:7

MILLING MACHINE- GEAR CUTTING
(INVOLUTED SPUR GEAR)

AIM

To cut a spur gear of 3 mm module and 30 teeth on the given gear blank.

MATERIALS REQUIRED

Cast Iron Gear blank with 100 mm diameter.

TOOLS REQUIRED

1. Vernier caliper
2. "V" nose tool
3. Gear milling cutter
4. Screwed mandrel
5. Drill bit.

CALCULATIONS

1. *Determination of gear blank* (To cut 3 mm module, 28 teeth)

Gear blank diameter = m (Z+2)

= 3 (28 +2)

= 90 mm.

Tooth depth = 2.25 m

= 2.25 X 3

= 6.75 mm.

Cutter pitch = 3 m

= 3 X 2.5

= 7.5 mm.

2. *Indexing*

Index crank movement = 40 / n

= 40 / 28

= 1 3/7

One full rotation and 9 holes in 21 hole circle in index plate.

3. Selection of gear cutter

= Cutter No:4 selected(range: 25 to 34 teeth)

LIST OF OPERATIONS

1. Outer diameter turning.
2. Indexing
3. Gear cutting

PROCEDURE

1. Copied the drawing.
2. Turned the gear blank to the required diameter and chamfered its two edges.
3. Fixed the gear cutter on the milling machine arbor.
4. Performed the Setting of Dividing head and Milling machine table.
5. The gear blank is mounted on a mandrel which is supported between the chuck of the dividing head and center of the tail stock. At a time one tooth space is cut by the milling cutter, and a dividing head is used to index the job to the next required tooth space. The cutter is chosen according to the module and number of teeth of the gear to be cut. Before the gear can be cut, it is necessary to check the cutter centered accurately relative to the gear holding mandrel. One way is to adjust the machine table vertically and horizontally until one corner of the cutter just touches the tail stock center. After centering of table, table make downward direction. The table is then fed vertically so that the blank just touches the cutter. The vertical dial is then set to zero. This is required to give the depth of cut on the job. After proper depth of cut, started gear cutting.

After one tooth space is cut, the blank is indexed through 1/z revolution by means of the dividing head, and the process is repeated until all the teeth are cut.

Gear cutting done with proper depth of cut.

6. Checked the number of teeth's and found correct.

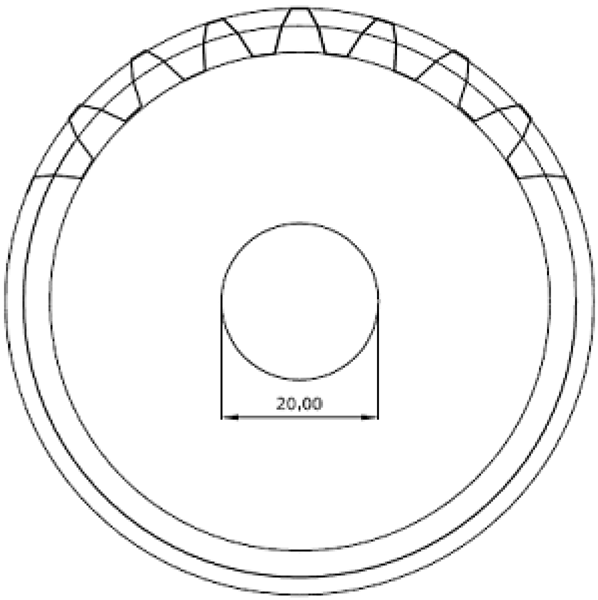
RESULT

The gear cutting is done on the gear blank keeping the module 3mm and 28 teeth with tolerance of +_ 0.02 mm.

<u>Involute Gear cutting</u>

Number of teeth = 28

Module = 3 mm



Tolerance +-0.02 mm

All dimensions are in mm