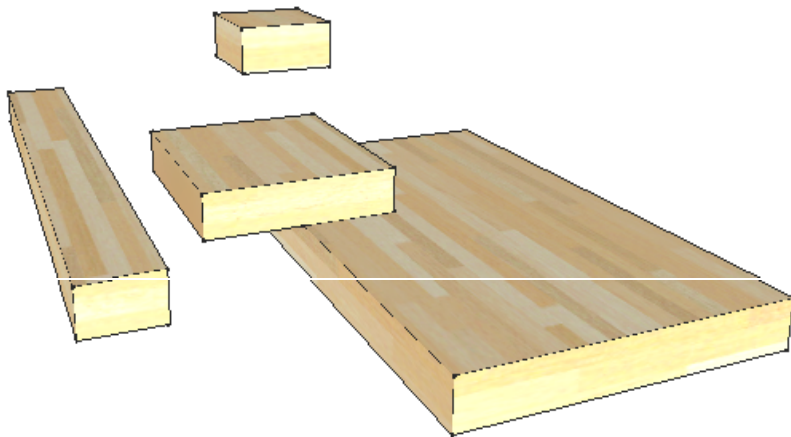
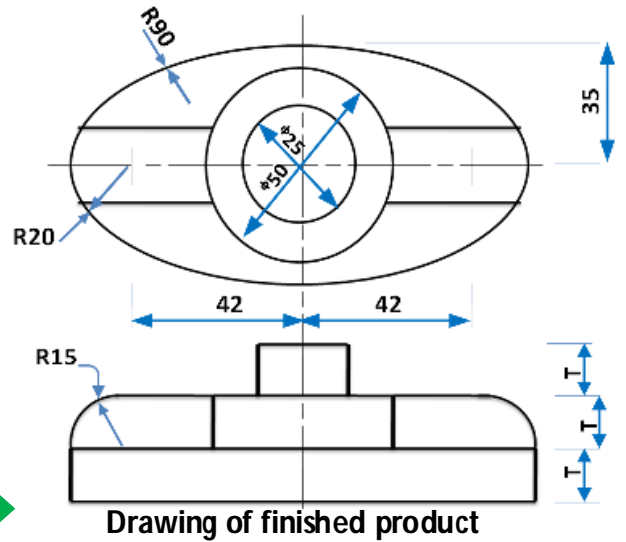


i.	Title of the Course	ME 113: Workshop Practice																								
ii.	Credit Structure	L(Lecture) – T(Tutorial) – P(Practical) – C(Total Credit): 0 – 0 – 3 – 3																								
iii.	Prerequisite, if any	Nil																								
iv.	Semester	Spring and Autumn																								
iv.	Course Content	<p>Introduction to Fitting and Pattern Making: Operations with various hand tools, Introduction to bench work, fitting tools and operations, Performing simple assignments in wood working and fitting independently.</p> <p>Introduction to Metal cutting and Machine tools: Learning of principles to work with basic machine tools e.g. lathe and shaping towards performing various machining operations, Performing simple assignments in lathe and shaping in groups.</p> <p>Introduction to Arc Welding: Learning of principles and working with shielded metal arc welding (SMAW) process, Performing simple assignments in on welding independently.</p> <p>Learning of safety measures in Fitting, Pattern Making, Metal Cutting and Machine tools, and Arc Welding.</p>																								
v.	Texts / References	<p>Hajra Choudhury S. K., Boe S. K., Hazra Choudhury A. K., Roy Nirjhar, <i>Elements of Workshop Technology</i>, Vol. I, Media Promoters and Publishers, Mumbai. 14th Ed., 2007.</p> <p>Hajra Choudhury S. K., Boe S. K., Hazra Choudhury A. K., Roy Nirjhar,, <i>Elements of Workshop Technology</i>, Vol.II, Media Promoters and Publishers, Mumbai. 12th Ed., 2007.</p> <p>Bawa H. S., <i>Workshop Practice</i>, Tata McGraw Hill, 2004.</p> <p>Sing, Rajender, <i>Introduction to Basic Manufacturing Processes and Workshop Technology</i>, New Age International Publishers, 2008</p>																								
vi.	Instructor (s)	A. De, I H Bhaldar, Y. Sonawanne																								
vii.	Relevance to other departments	This is a compulsory course for all first year students																								
viii	Justification	N.A.																								
ix.	Assessment Plan	<table><thead><tr><th><u>TRADE</u></th><th><u>No. of Days</u></th><th><u>Location</u></th><th><u>Weightage</u></th></tr></thead><tbody><tr><td>Pattern Making</td><td>02</td><td>F3 Shed</td><td>14%</td></tr><tr><td>Fitting</td><td>02</td><td>F3 Shed</td><td>14%</td></tr><tr><td>Lathe</td><td>02</td><td>N2 Shed</td><td>14%</td></tr><tr><td>Shaping</td><td>02</td><td>N2 Shed</td><td>14%</td></tr><tr><td>Welding</td><td>02</td><td>N3 Shed</td><td>14%</td></tr></tbody></table> <p>End-Semester Practical Test: 15%</p> <p>End-Semester Quiz: 15%</p>	<u>TRADE</u>	<u>No. of Days</u>	<u>Location</u>	<u>Weightage</u>	Pattern Making	02	F3 Shed	14%	Fitting	02	F3 Shed	14%	Lathe	02	N2 Shed	14%	Shaping	02	N2 Shed	14%	Welding	02	N3 Shed	14%
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PATTERN MAKING SECTION

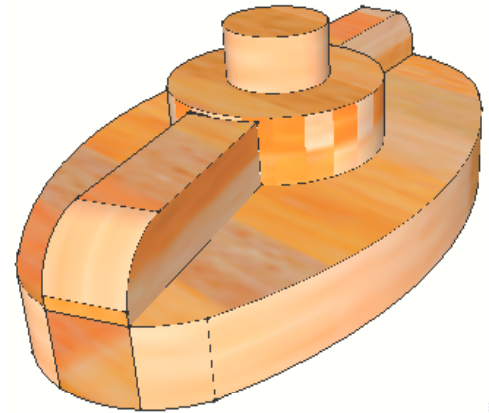


Raw Material



Drawing of finished product

Operations	Activities involved
Marking and Layout	Mark on the raw material (woods) as per drawing using marking and measuring tools.
Cutting	Cut raw material as per marking with appropriate margin for filling.
Filling	File now the parts using rasp to the final shape as per drawing.
Finishing	Finish all surfaces with wooden sand paper no. 80.
Assembly	Assemble all parts using adhesives (Fevicol) and Nails.



Expected Shape of assembled pattern

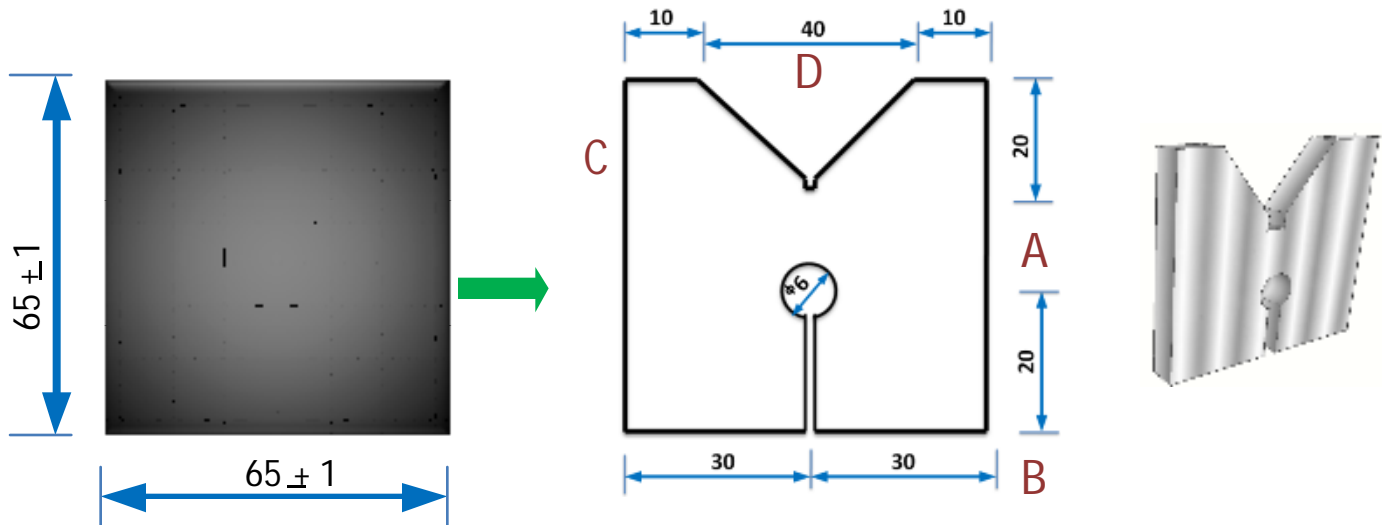
Expected performance

- Try to match the dimensions as per drawing.
- Available time to complete the job is 6 hrs.
- Each student must perform an independent job.
- Follow all safety instructions.



Key words (for self study): Pattern Making and Casting, Wood Working

FITTING SECTION



Raw Material

Drawing of finished product

Operations	Activities involved
Measurement	Measure raw material given to you – it should have a size of more than 60×60×6 mm.
Filing	Make a flat surface using a second cut file on any edge of the w/p (e.g. A). With reference to that surface, make another right angled flat surface adjacent to it (e.g. B).
Marking	Apply wet chalk on w/p surface and allow it to dry to increase visibility of marking lines. Mark as per the drawing with reference to the flat surfaces using Vernier height gauge, Surface Plate and Angle Plate.
Punching	Do permanent marking on the marked lines using Hammer and Center punch
Cutting	Cut all excess material from w/p using hacksaw with a 2 mm margin for filing. Make a small notch as shown.
Filing	File all the cut surfaces with all the edges at right angle to the adjacent surface, unless specified in the drawing.
Drilling	Mark a punch to drill a hole at the required location. Use a twist drill for drilling.
Slitting	Make a slit at mid point opening in to drilled hole as shown in drawing.
Finishing	File the top and bottom surfaces to remove the burrs and check with master piece for fitting.

Expected performance

- Follow all safety instructions.
- Try to match the dimensions as per drawing.
- Time to complete the job is 6 hrs.
- Everybody must make an independent job.
- Try to remove sharp edges, burrs through proper filing operations.



Hack Saw Blade, Flat File, Round File



Centre Punch, Scriber, Hammer



Tri Square, Scale



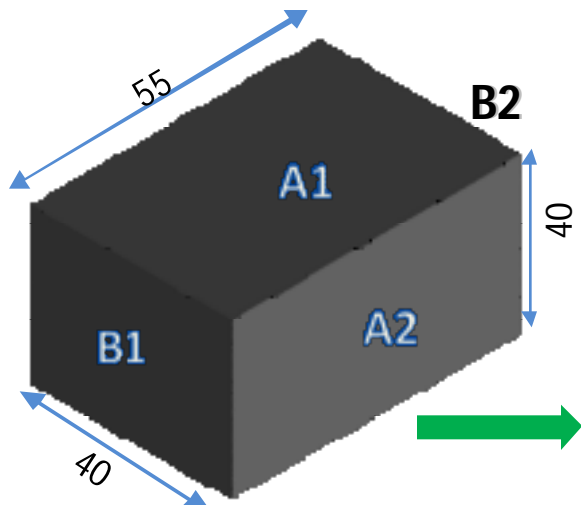
Vernier height gauge, angle plate, surface plate



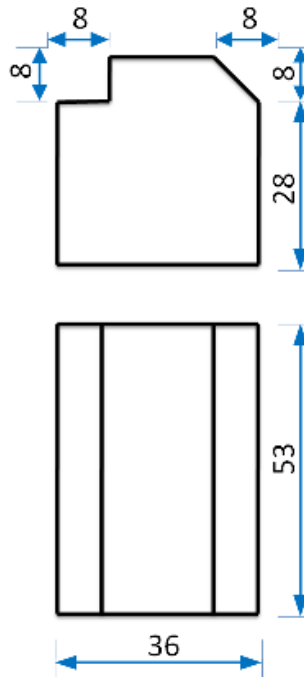
Bench Vice

Key words (for self study): Fitting and Bench working with mild steel, Different file specifications.

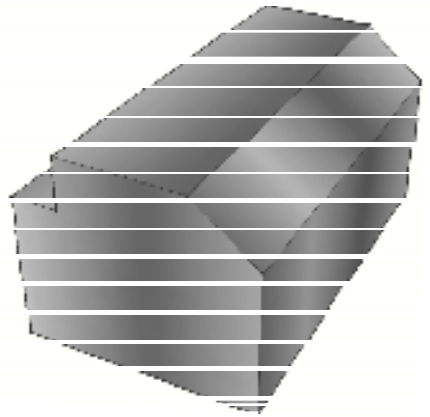
SHAPING SECTION



Raw Material



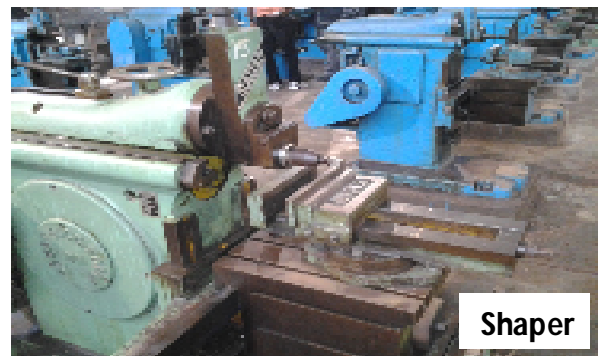
Drawing of Finished Part



Operations	Activities involved
Machining of surface	Clamp w/p in Machine Vice. Machine surface B1 using a single point cutting tool in shaper.
- do -	Machine surface B2 with reference to B1. Use a parallel block for reference.
- do -	Machine surface A1 . Use a parallel blocks for reference.
- do -	Machine surface A2 with reference to A1. Use a <i>try square</i> for reference.
- do -	Machine surfaces A3 and A4 after marking with Vernier height gauge, Hammer, Center Punch to get final job dimensions as per drawing,
Machining a 8x8 square step	Machine the square step in shaper – adjust tool angle and relative height using Vernier height gauge and surface plate.
Machining a slant surface	After marking slant edge, machine the surface by adjusting it parallel with respect to the tool motion.

Expected performance

- Follow all safety instructions.
- Try to match the dimensions as per drawing.
- Time to complete the job is 6 hrs.
- Each group must make an independent job.
- Try to remove sharp edges, burrs through light filing operations.



Shaper

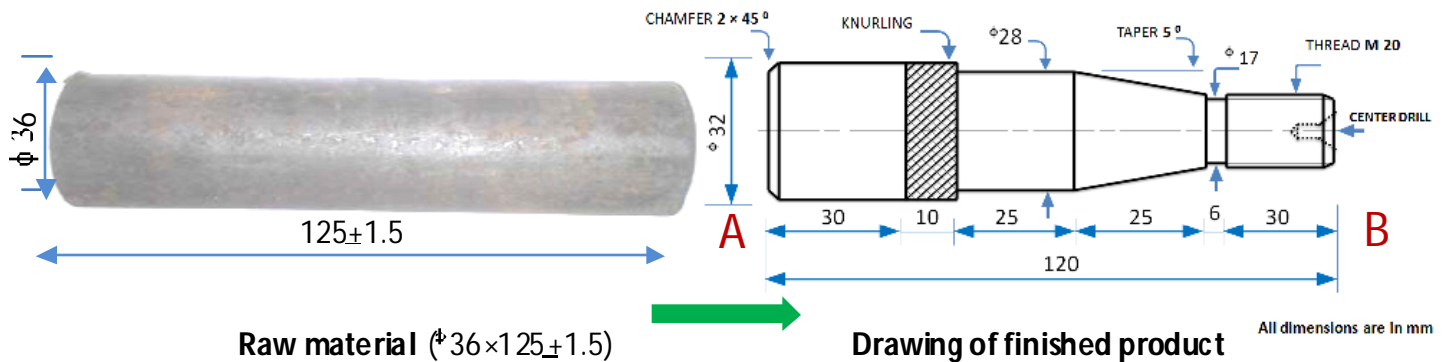


Single point cutting tool

Key words (for self study):

Shaping machine, Quick return mechanism, Single point cutting tool

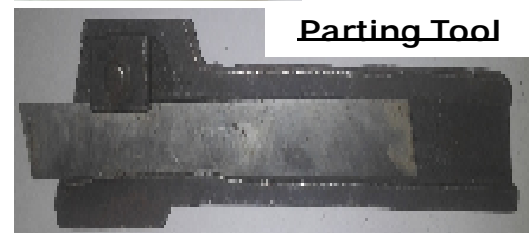
LATHE SECTION



Operations	Activities involved
Facing	Clamp the job on a 3 jaw chuck with the chuck key. Perform facing using a single point cutting tool such that the machined surface (B) becomes perpendicular to the job axis.
Outer diam. Turning	Adjust angle of tool by tool post. Perform turning to 32 mm diameter up to a length of 50 to 60 mm. Check dimension with outside caliper.
Chamfering	Adjust tool edge to 45° and perform chamfering to remove sharp edge. Unclamp the Job.
Facing and Center drilling	Clamp the job from the other side (A) for facing of surface B. Further, use a center drill and drill chuck to make a center drill on surface B.
Step turning	Unclamp and support job using a live center for step turning as per drawing i.e. $\phi 28$ on entire length and subsequently, $\phi 20$ on 36 mm length.
Grooving	Make a groove of $\phi 17$ diameter for a length of 6 mm as per drawing by using a parting off tool.
Taper turning	Set the angle of compound slide to the required taper degrees. Give feed to compound slide only. Make the chamfer on B.
Thread cutting	Arrange necessary gear train required for pitch of the thread to cut. Engage lathe machine in back gear and lead screw with split nut. Carry out thread cutting in steps in forward direction.
Knurling	By using a knurling tool do a diamond serrations on the job for better gripping.

Expected performance

- Follow all safety instructions.
- Try to match the dimensions as per drawing.
- Time to complete the job is 6 hrs.
- Each group must make an independent job.

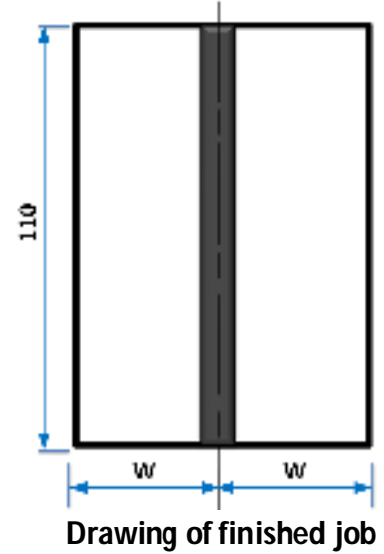
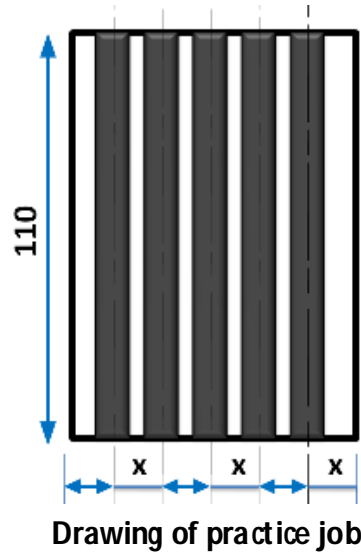
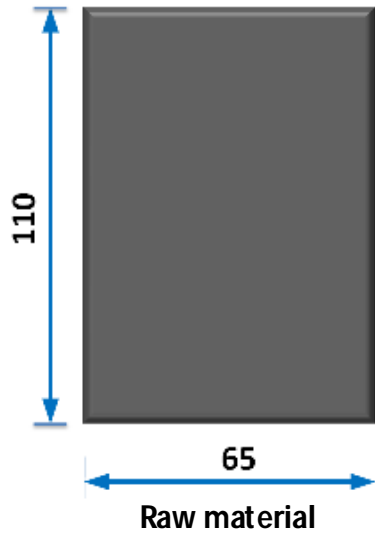


Key words (for self study)

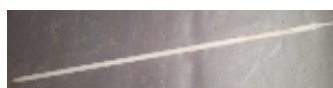
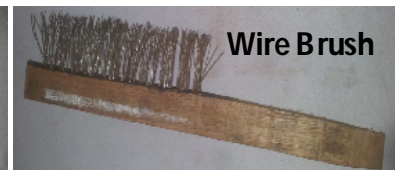
Lathe machine and tooling, lathe operation and parameters.



WELDING SECTION



Operations	Activities involved
Practice job	Prepare beads-on-plate parallel to each other using a shielded metal arc welding (SMAW) machine and flux coated electrodes. Try to deposit as many parallel lines as you can on the plates given for practice. Follow strictly all safety norms [e.g. wearing of gloves, aprons, etc., use always hand-held eye-shields during welding or observing welding of your friends]
Final job	Follow the same procedure as above and prepare a single and straight bead-on-plate deposit on the final plate / job. Use a tong to hold the hot job and dip it in water tank for cooling.
Chipping off	After the job is cooled down, use the chipping hammer to remove slag and spatter.
Brushing	Brush off the weld surface for cleaning.

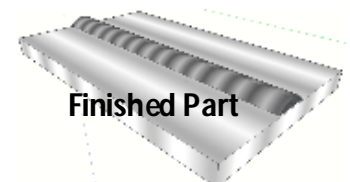


Expected performance

- Follow all safety instructions.
- Time to complete the job is 6 hrs.
- Everybody must make an independent job.

Key words (for self study)

Shielded metal arc welding (SMAW), Flux coated electrodes, Welding current, voltage and speed



Safety Norms to be followed at Central Workshop

1. Shoes must be worn in the shop area. No one **wearing sandals** will be allowed to enter the shop area. **The minimum footwear must cover the entire foot.**
2. Do not operate any item of equipment unless you are familiar with its operation and authorized to operate it. If you have any question regarding the use of equipment ask the concerned staff.
3. No work may be performed using power tools unless at least two people are in the shop area and they can see each other.
4. In case of injury, no matter how slight, report it immediately to the staffs available. The IIT Bombay Hospital phone number is **7051. Ambulance - 1101**
5. Machine **must** be shut off and not moving when you are cleaning, repairing, oiling, or when you leave the area. **Never** leave a machine running unattended.
6. Do not wear ties, loose clothing, jewelry, gloves, etc. around moving or rotating machinery. Long hair must be tied back or covered to keep it away from the moving machinery. Hand protection in the form of suitable gloves should be used for handling hot objects, glass, or sharp-edged items.
7. Do not work in the shop if you are **tired, upset, or in a hurry.**
8. A brush, hook, or special tool is preferred for removal of chips, shavings, etc. from the work area. **Never use your hands.**
9. Keep fingers clear of the point of operation of machines by using special tool or devices, such as, push sticks, hooks, pliers, etc. **Never use a rag near moving machinery!**
10. **Practice cleanliness and orderliness in the shop areas.** Keep the floor around the machines clean, dry, and free from trip hazards. Do not allow chips to accumulate.
11. Think through the entire job before starting. Before starting a machine, always check it for correct setup and if the machine is clear by operating it manually, if possible.
12. Use an equipment for its intended purpose only.
13. **Do not** use cell phone while you are operating a machine tool.
14. Do not use machinery and or power hand tools without proper training. If you do not know how to operate a power tool or machine, or do not fully understand the instructions you have been given, ask an instructor or staff member for help.
15. Do not use gloves while operating machinery, since they can become entangled in rotating tools. Do not touch any rotating component of a machine until it is completely stopped.
16. Use care when handling cutting tools. Cutting tools are very sharp! Wrap tools in a rag when removing or installing cutting tools.
17. Do not distract people operating machines, which includes speaking to them or creating a sudden noise or any foul activity. Do not allow yourself to be distracted. If you must talk, bring machinery to a complete stop first. If you are asked to stop the operation of a machine, then do so immediately! Do not leave machines running while unattended.
18. Many hazards exist in a machine shop. Before you move a heavy object, swing a hammer, or engage any machine power, think about the consequences of your actions. How and where are you going to put the heavy object down? Are your fingers going to get caught? Are somebody else's fingers going to get hurt? When the power comes on, will tools fly? Will cutting tools run into things they aren't supposed to hit? **PLEASE THINK BEFORE YOU ACT!**