D.E.I. FACULTY OF ENGINEERING

MEM-103: MANUFACTURING PROCESSES - I

QUESTION BANK

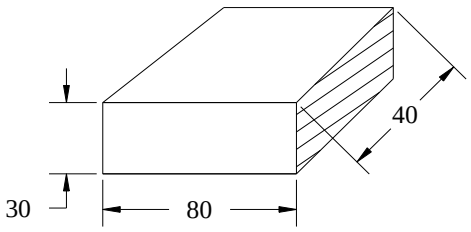
UNIT-I:

1. Define the term '*manufacturing'*. Provide a broad classification for existing *manufacturing* processes. Clearly explain the differences between the identified classes.
2. Provide a detailed historical account for the development of *machine tools*.
3. How does *manufacturing* play its role in standard of living in a country? Discuss qualitatively.
4. What is *safety*? Why it is necessary and how does it pay in the long run? What are the principle methods of protection against *accidents*? Give a brief description of each. What do you understand by *unsafe conditions* and *unsafe acts* of persons working in factories?
5. What *safety* precautions are taken while working in a *machine shop*? What do you understand by the term *housekeeping*? What precautions and *safety* measure you will take while working on following machines: *lathe*, *shaper*, *milling* and *drilling*.
6. List the different property classifications of materials that determine their applicability. Differentiate among the basic categories of engineering materials in terms of their chemical and mechanical characteristics.
7. Schematically represent and explain the *stress-strain* behaviour for *mild steel*, and then explain how the *yield strength* is determined.
8. Define the following mechanical properties: *tensile strength*, *compressive strength*, *ductility*, *hardness*, *toughness*, *fatigue strength*, *creep resistance*, *malleability*, *stiffness*, *resilience*, *elastic* and *proportional limits*.
9. What are *ferrous* and *non-ferrous metals*? Explain the advantages, disadvantages, properties and applications of each of the following *non-ferrous metals*: *Al*, *Cu*, *Ti*, *Mg*, *Zn*, *Ni* and *Pb*.
10. Explain the advantages, disadvantages, properties and applications of each of the following: *plain carbon steel*, *mild steel*, *tool steel* and *high carbon steel*.
11. What is *cast iron*? Classify it. Illustrate properties & application of *S.G. iron*.
12. What are *plastics*? How are they classified? Explain common *plastics* and their applications.
13. What are *ceramics*? Explain their properties and applications.
14. Define *heat treatment*. What are the main objectives of *heat treatment*? Write short notes on the following: *annealing*, *normalising*, *hardening* and *tempering*.
15. Explain with neat sketches, the important furnaces used for *heat treatment*. What is the main purpose of *case hardening*? Explain the principal methods of *case hardening*.

16. What are the properties of *soft* and *hard wood*? Explain with examples, the extant Indian varieties of *wood*. What are the common defects in *timber*? Describe the various methods employed in preserving *timber* for increasing its durability?
17. What do you mean by *seasoning* of *wood*? What are the different methods of *seasoning*? What are the advantages of *wood seasoning*?
18. Describe briefly, through neat sketches, the various tools used in *carpentry shop*.
19. Enumerate the different types of *joints* used in *carpentry* work, together with their specific uses. Which of these *joints* are more commonly used in wooden framework? Use sketches to support your answers.
20. Design a *wooden stool* for use in masonry work. Indicate the type of *joints* used, together with the processes used in making them.
21. What is *plywood*? Describe how it is manufactured. State the advantages of *plywood* as a structural material over ordinary *timber*? What are the differences among *ply-boards, compressed-boards*, and *straw-boards* commercially available in the market in the form of *artificial wood*? Explain their field of application in daily life.

<u>UNIT-II</u>:

1. Identify the six basic steps involved in all *casting* processes. What do you understand by the term '*pattern'*? Explain with neat sketches the various types of *patterns* used in *foundry* practice. Mention their typical use.
2. What are the various materials used for making *patterns*? Mention their specific uses. What design considerations are taken into account while making *patterns*? Describe the *pattern colour codes* normally used in *foundries*.
3. What are the various *allowances* given on *patterns*? Why are these *allowances* necessary? A job shown below is to be made from *steel* by *casting* process. The *mould* for this job is made from *wooden pattern*. Determine the dimensions of the *wooden pattern* assuming *machining allowance* of 3 *mm* on each side, *shaking allowance* of 1 *mm* on length and width, *shrinkage allowance* of 3%, and *taper allowance* of 1°.



4. A cubical *casting* of 100 *mm* side is to be made from *steel* using an *Al pattern* (*master pattern*). For preparing the *master pattern*, a *wooden pattern* is used. Determine the dimensions of *master pattern* and *wooden pattern*. Use *shrinkage allowance* (*mm*/*mm*) for *steel* and *Al* as 0.021 and 0.013 respectively.

5. What do you understand by the term '*moulding'*? Explain, in brief, the important factors in the selection of *moulding sands*. What are the various *sands* used for *moulding*? Explain the various characteristics that good *moulding sand* should possess. Mention some of the *moulding sand* ingredients used to achieve a sound *mould* in *sand castings*.
6. What are *cores*? Explain the various materials used for making *cores*. What are some of the characteristics desirable in a *dry-sand core*? What is the major limitation of *green-sand cores*? What are *core-prints* and *chaplets*? What are some of the restrictions on their use, size, and chemistry?
7. Explain the importance and function of *gates*, *risers* and *runners* in a *mould*. What are *risers*? Why is it desirable to restrict the size and use of *risers*? Explain the importance of *Chvorinov's rule* in the context of *sand casting*. What are some of the design functions of a *gating* and *feeding* system?
8. The *downsprue* leading into the *runner* of a certain *mould* has a length of 175 *mm*. The cross-sectional area at its base is 400 mm^2. The *mould cavity* has a volume of 0.001 m^3. Determine: (a) the *velocity* of the *molten metal* flowing through the base of the *downsprue*, (b) the *volumetric flow rate*, and (c) the *time* required to fill the *mould cavity*. In this problem, if the same *alloy* and *mould* type were used, find the *total solidification time* for a cylindrical *casting* in which the diameter = 30 *mm* and length = 50 *mm*.
9. In *casting* experiments performed using a *Ti-alloy* and a *zircon sand mould*, it took 155*s* for a cube-shaped *casting* to solidify. The cube was of 50 *mm* side. Determine the *mould constant*.
10. In a *foundry*, three *castings* of same weight and material are to be produced. Shapes of the three *castings* are: a cube, a sphere and a cylinder. Find the *cooling time ratio* in all these cases. Assume, for cylindrical shaped *casting*, a length to diameter ratio of 0.5.
11. Explain with the help of neat sketches, the *sand casting* operation in detail. What are some of the *cleaning* and *finishing* operations commonly performed on *castings*?
12. Explain in detail the functioning of a *blast* furnace / *cupola* for the production of *pig iron* used in *casting*. What is the difference between a *blast* furnace and an *induction* furnace?
13. What are the various *defects* generally found in *sand castings*? Explain why they occur and how they can be avoided or eliminated?
14. Explain various *moulding* processes used in *sand casting*. What are the various types of *moulding* machines employed in *foundries*? What are the advantages of using these machines in *foundries*?
15. Calculate the *permeability number* of a sand specimen if it takes 75*s* to pass 2000 cm^3 of air at a pressure of 6 g/cm^2 through the standard sample.
16. Enumerate various *permanent-mould casting* techniques. Explain them in brief.

17. Describe the *shell moulding* operation in detail. What are three major advantages of the *shell moulding* process? Why must moderate-to-large quantities be required to justify the *shell moulding* process?
18. Elaborate on the *evaporative-pattern casting* technique in detail. Use neat sketches for clarity. Explain some of the salient features of the technique.
19. Describe the *investment casting* process in detail. Use neat sketches to elaborate your description.
20. Describe the *die casting* process in detail. Use neat sketches for clarity. Differentiate clearly between *hot-chamber die casting* and *cold-chamber die casting* processes.
21. What is the difference between *true centrifugal* and *semi-centrifugal casting*? Describe the *centrifugal casting* process in detail. Use neat sketches to elaborate your description.

UNIT-III:

1. Distinguish between *hot working* and *cold working* of *steel*.
2. Describe with neat sketches the following equipment used in a *smithy shop*:
   (a) *Smithy's forge* (b) *Anvil* (c) *Swage block*
3. Differentiate between *hand hammers* and *sledge hammers* through neat sketches.
4. What operations are performed in a *smithy shop*? Describe each operation with suitable examples.
5. Why are *hot rolled* products normally available only in standard sizes and shapes? Why the friction between tool and work-piece is not an undesirable feature in *hot rolling*? Why might small-diameter rolls be desired when *rolling* thin products?
6. What are the common metals used in *forging*? Also identify the *forging* temperatures of some common *forgeable* metals.
7. Describe the *drop forging* operation in detail. What is the difference between *open-die* and *impression-die drop forging*? Why is *open-die forging* not practical for large scale production of identical products? Why are multiple steps often required in the production of an *impression-die forging*?
8. What is *flash-less forging*? What is its major advantage?
9. What are the advantages of a *counterblow* or *impact forging* machine? What are some of the properties desired in *forging dies*?
10. Why must *press forging* often employ heated *dies*?
11. What is *upset forging*?
12. What two *hot forming* processes can convert *steel skelp* into *pipe*?
13. Elaborate on the commonly found *forging defects*.
14. What is the *Mannesmann milling* process? Why is the *Mannesmann piercing* process not capable of producing extremely long lengths of *seamless tubing*?

15. For what types of products might *hot drawing* be used instead of *cold drawing*?
16. What do you understand by the term '*cold drawing*'?
17. What do you understand by metal *spinning*? Explain with the help of neat sketches, the *shear spinning* operation in detail.
18. Differentiate clearly between *shear spinning* and *tube spinning* operations through neat sketches.
19. Explain through neat sketches the *bar, tube* and *wire drawing* processes. What are the materials used for *drawing dies*?

UNIT-IV:

1. Provide a detailed classification for the different contemporary *welding* techniques.
2. Differentiate among *autogeneous*, *homogeneous* & *heterogeneous welding* processes.
3. What do you understand by *gas welding*? Describe in brief, the equipment required for *oxy-acetylene gas welding*. Enumerate the advantages and limitations of *gas welding*.
4. Differentiate clearly between *low-pressure welding* and *high-pressure welding*. What care should be taken in operating these equipment?
5. Describe with neat sketches, various types of *joints* made in *welding*.
6. What is the *electric arc welding*? Describe the process in detail.
7. What do you understand by the term '*polarity'* as applied to *arc welding*? What are the basic types of *current* and *polarity* that are used in *arc welding*? What are some of the process variables that must be specified when setting up an *arc welding* process?
8. What types of *electrodes* are used in *arc welding*? What is the advantage of using *coated electrodes*?
9. Name six types of *resistance welding* methods. For what kind of production, *resistance welding* is mainly employed.
10. Write short notes on:
    (a) *Butt welding* (c) *Spot welding* (e) *Flash welding*
    (b) *Seam welding* (d) *Percussion welding* (f) *Projection welding*
11. Explain briefly, the following types of *flames* with neat sketches:
    (a) *Neutral flame* (b) *Carburising flame* (c) *Oxidising flame*
12. What are some of the common types of *weld defects*? Explain each category.
13. Two 1.2 *mm* thick flat *copper* sheets are being *spot welded* using a *current* of 6000 *A* and a *current flow time* of 0.18 *s*. The *electrodes* are 5 *mm* in *diameter*. Estimate the heat generated in the *weld* zone. Take effective *resistance* as 150 $\mu\Omega$. Also calculate temperature rise assuming that the heat generated is confined to the volume of material directly between the two electrodes and temperature is uniformly distributed.

UNIT-V:

1. What do you understand by (a) *cutting tools*; (b) *hand tools*; and (c) *machine tools*? Explain with examples.
2. Give the nomenclature of a *single-point cutting tool*. Explain each of its elements in detail.
3. Differentiate clearly between *attachment*s and *accessories* in the context of *machine tools*. What are the basic units of a *machine tool*?
4. Describe (using neat sketches) some of the standard *attachments* & *accessories* used on a *lathe*.
5. Explain with the help of a simple sketch the constructional details of a *lathe* / *shaper* / *planer* / *drill machine*. What specifications need to be mentioned when purchasing each of these *machine tools*?
6. What are the different operations that can be performed on a *lathe*? Support your answer with simple sketches.
7. How is *taper-turning* accomplished on a *lathe*? Explain the different techniques used.
8. A 6.5 *inch* long, 0.5 *inch* diameter stainless steel rod is being reduced to 0.480 *inches* by *turning* on a *lathe*. The spindle rotates at 400 *RPM* and the tool is travelling at an axial speed of 8 *inches*/*min*. Calculate the *cutting speed*, *feed*, *time*, and *material removal rate* required.
9. Describe the cutting tool geometry of a *twist drill* through a neat sketch. What operations can be performed on a *drill press* but not on a *lathe*? Explain how *gun drills* remain centred. Also, why is there a hollow channel in a *gun drill*?
10. Why are *coolants* required in metal cutting? What is the effect of a *coolant* on surface finish?
11. If a *V-block* is to be shaped on the *shaper*, show how will the *tool head* be set?
12. What is *grinding*? Explain the nomenclature of a *grinding wheel*.
13. With the overall knowledge of metal machining, suggest the minimum variety of machines, a workshop should possess so that the company can produce component of any shape. Justify your answer.
14. What do you mean by *tool wear*? Explain with neat sketches.