Problem Sheet: Casting

Problem-1: *Suggest a suitable pattern* for casting the components shown in Fig., P-1 a-d. Fig., P-1 a-d, is a single piece casting and large number of small castings are required of identical parts shown in Fig P-1 a-d. *Justify your selection.*
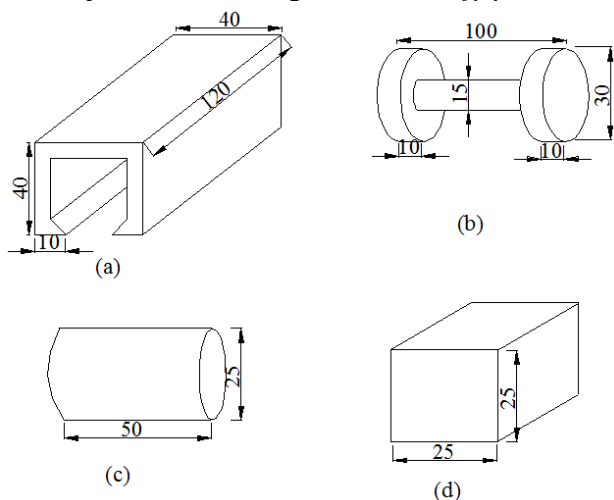

(a)

(b)

(c)

(d)

Figure: P-1: Jobs to be produced by casting

Problem-2: A job shown in Figure, P-2, 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%

Figure, P-2: Part to be produced by casting

Problem-3: A job shown in the Figure, P-3, is to be made of steel by casting process. The mould for this job is made from a wooden pattern. *Determine the dimensions of the wooden pattern.* Assume machining allowance of 2 mm on each side, shrinkage allowance of 2% and a taper allowance of 1^0.
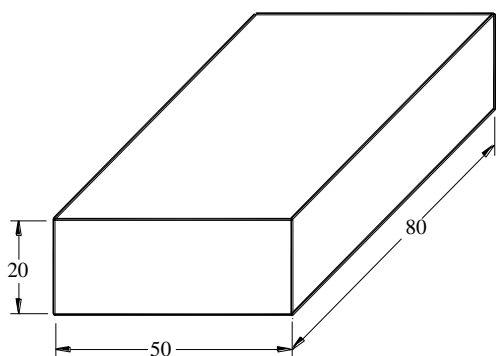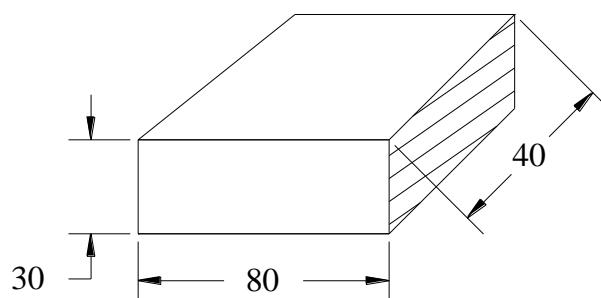

Figure: P-3: Component to be produced by casting

Problem-4: A cubical casting of 100 mm side, as shown in Figure, P-4, 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 0.0210 and 0.013 respectively.

Figure, P-4: Casting to be produced in steel

Problem-5: A mould cavity has the shape of a cube, 100 mm on a side. *Determine the volume and dimensions of the final cube after cooling to room temperature if the cast metal is copper.* Assume that the mould is full at the start of solidification and that shrinkage occurs uniformly in all directions. For Cu, solidification shrinkage is 4.9%, solid contraction during cooling is 7.5%.

Problem-6: The downsprue leading into the runner of a certain mould has a length = 175 mm. The cross-sectional area at the base of the sprue is 400 mm^2. The mould cavity has a volume = 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.*

Problem-7: 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.

Problem-8: Given: height of sprue (ht) = 20 cm; area of sprue (A_3) = 2.5 cm^2; volume of mould cavity (V) =1560cm^3, *Find: v_{sprue}; Flow rate (Q); Mould filling time.*
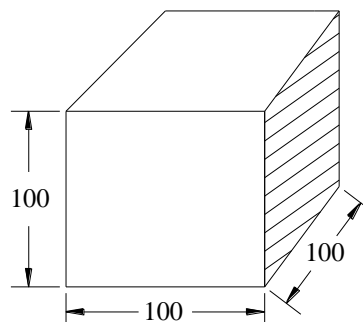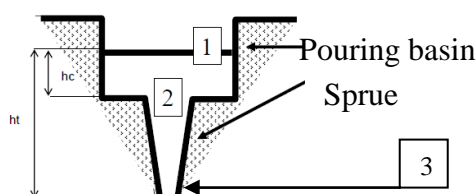

Pouring basin

Sprue

Problem-9: In casting experiments performed using a Ti alloy and a zircon sand mould, it took 155s for a cube-shaped casting to solidify.   The cube was 50 mm on a side. *Determine C$_m$.*

Problem-10: If the same (Problem -9) 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.