ME 206
Instructor: Ramesh Singh
HW#1

Date assigned: 14.01.2022
Date due: 21.01.2022

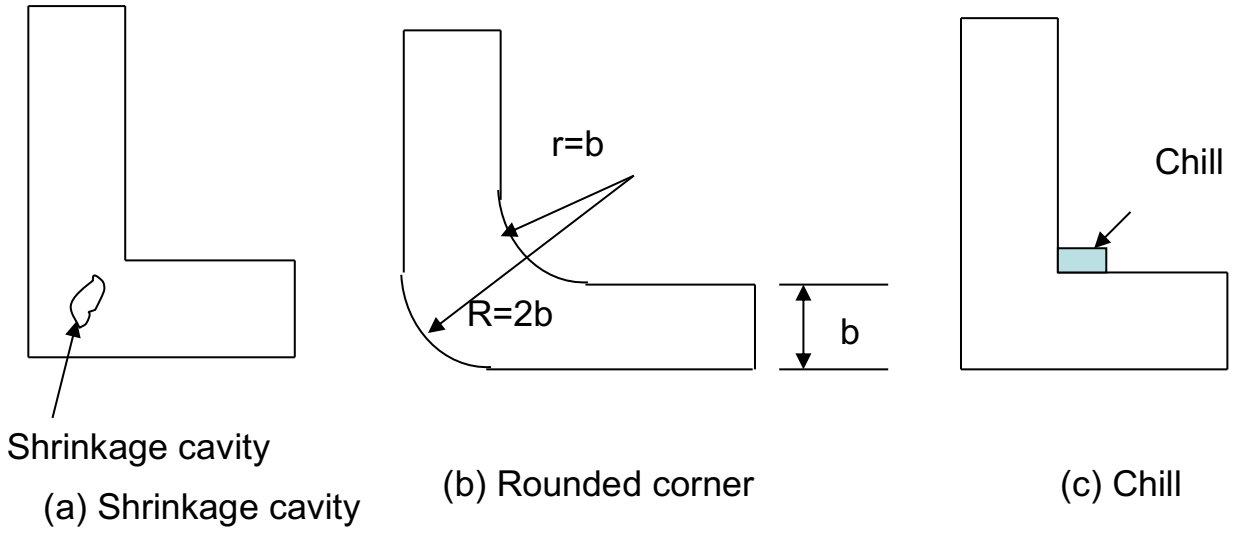
1. You are designing cylindrical risers for an engine block that will be sand cast from cast iron (this is an insulating mold). The characteristic dimension for heat transfer for the casting is 30 mm (V/A). Assume that the riser is placed on the top of the casting and the top surface of the riser is insulated.
   - Determine the diameter of the riser
   - If we improve the insulation of the riser so that the rate of heat transfer heat in the riser is one-third of the sand mold, determine the diameter of the riser. Physically explain your findings.

2. You are designing a sprue/runner/gate system to sand cast a part. The top of the sprue is 5 cm above the gate (h_t), and contains a pouring basin, which is 2 cm deep (h_c). The diameter of the top of the sprue is 2 cm. The metal being poured has viscosity = 2.25x10-3 N-s/m^2 and a density of 2500 kg/m^3. This is a top gated mold. Determine the diameter of the runner, if you wish there to be no aspiration. Determine the Reynolds number and comment on its value and any implications.

3. Determine the solidification time of the following two iron castings when both are poured with no superheats into sand molds at initial temperature of 28^0C.

   - A slab shaped casting 10 cm thick (h =10 cm) (Hint: Assume l, b >> h)
   - A sphere 10 cm in diameter

4. While casting an L section, a shrinkage cavity is formed as shown in the figure. Explain physically why the shrinkage cavity is avoided in (b) and (c) of the figure.



(a) Shrinkage cavity (b) Rounded corner (c) Chill