1. A 300-mm long, 100-mm diameter titanium alloy rod is being reduced in diameter to 95 mm by turning on a lathe. The spindle rotates at 400 rpm, and the tool is traveling at an axial speed of 250 mm/min. (25 pts.)
Calculate the cutting speed, MRR, time of cut, power required, and the cutting force.

2. A four-fluted end mill of 40 mm diameter is performing an up milling operation into a workpiece of 1035 steel. The width of cut is 25 mm and the depth of cut is 20 mm. The peripheral speed of the cutter is 45 m/min, and the feed is 0.25 mm/tooth. The specific energy of the work material is 2300 Ws/cm^3. Determine (30 pts.)
(1) Spindle speed (rpm) (5 pts.)
(2) Feed rate (mm/min) (5 pts.)
(3) MRR (cm^3/min) (10 pts.)
(4) Power (kW) (10 pts.)

3. A NC drill press is to perform a series of through-hole drilling operations on a 1.75-in. thick aluminum plate that is a component in a heat exchanger. Each hole has a 0.75 in. diameter. There are 100 holes in all, arranged in a 10×10 matrix pattern, and the distance between adjacent hole centers (along the square) is 1.5 in. The cutting speed is 300 ft/min, the penetration feed (z-direction) is 0.015 in./rev, and the feed rate (x-y plane) between holes is 15 in./min. Assume that x-y moves are made at a distance of 0.5 in. above the work surface and that this distance must be included in the penetration feed rate for each hole. Also, the rate at which the drill is retracted from each hole is twice the penetration feed rate. The drill has a point angle 100°. Determine the time required to finish all of the holes, assuming the most efficient drilling sequence will be used to accomplish the job. (30 pts.)

4. Suppose we want to make the part shown in the right picture out of cast iron in the left figure. Propose a process plan to make the part including the planned process, sequence, machines, and cutting tools. (15 pts.)