

Me. 423.3 Machine Design II

19 February 1999

1.5 Hour, Open Book Examination Course Text, Notes and Calculators are allowed.

The Student should attempt three (3) of the four (4) questions.

1. Design a helical tension spring that is to have an outside diameter of 0.3in or less. The spring should have a spring constant k of 77 lb/in. The solid height of the body of the spring should be less than 0.5 inches long. The maximum load on the spring is to be 10 lbs.
2. Select a V-Belt drive for a 7.5 hp squirrel cage electric motor driving a centrifugal pump. The motor has a nominal speed of 1750 rpm the pump speed should be 1600 rpm with a 5 rpm difference being considered acceptable. The center distance is to be 36 to 42 inches. Use a 1.2 service factor.
3. Select a roller chain drive for an application where the center distance is 0.3m, the system should have a 1.3 service factor. The power to be transmitted is 740W and the driving shaft is rotating at 800 rpm. The speed of the driving shaft should be 385 +/- 1 rpm.
4. As part of a mechanical computing device being designed for a science display you are to design a two stage set of gears to have a speed ratio of $13^{0.5}$. The power to be transmitted by the gears is 0.05 hp with an input speed of 6000 rpm and an output speed of approximately 21633.3076528. The contract has a large bonus for each extra decimal place of accuracy. For the purposes of this examination, design the input stage only for failure by bending fatigue and the output stage for failure by surface wear. The machine is to be designed to operate 1 hour per day for 50 years.