*本科於考試中不得參閱任何資料!!!

1. Explain (a) what is "machine"? and (b) what is "machine design"? (10%)

2. Explain the following terms: (20%)
   (a) Standard bending fatigue strength.
   (b) Maximum-shear-stress theory of static failure.
   (c) Rating life (or L_{10} life) of bearings.
   (d) Splines.

3. A 20° stub spur gear has 32 teeth and a pitch diameter of 160 mm. Determine its (a) module, and (b) base pitch. (10%)

4. The crankshaft of a punch press rotates 60 rpm, causing holes to be punched in a steel part at the rate of 60 punches per minute. The crankshaft torque requirement is shown in Fig. 1. The press is driven by a 1200 rpm motor. Assume that the flywheel rotates at 1/3 motor speed and is to limit motor speed fluctuation to the range of 900~1200 rpm. The flywheel is to be made of steel and have the geometric proportions shown in Fig. 2. Assume the inertia contributed by the hub and arms is negligible. Determine the required flywheel polar moment of inertia I and diameter d. (20%)

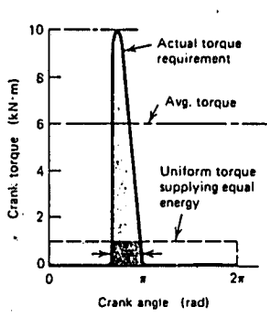

Fig. 1

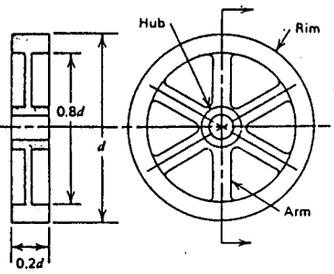

Fig. 2

5. Fig. 3 shows a press as a household trash compactor. Base on the force-flow concept, please answer the following questions: (20%)
   (a) Are the screws in compression or in tension?
   (b) How to improve this design?

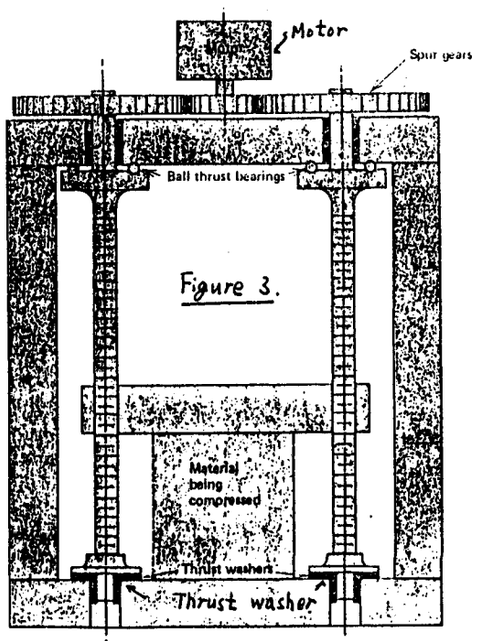

Figure 3.

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6. A steel helical spring has a helix diameter and a wire diameter of 40 mm and 4 mm, respectively. When a mass of 40 Kg is suspended vertically by this spring and pulls 10 mm below its position of rest and then released will make 60 complete oscillations per minute. Find the number of active coils if the effect of the mass of the spring is neglected. The shear modulus of steel is 79 GPa. (20 %)