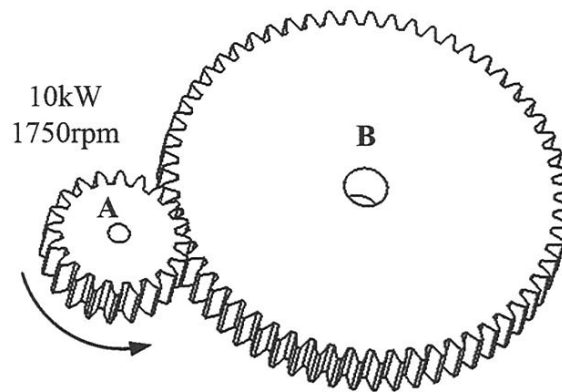


1071 機械系博士班資格考試題目

考試科目	方式	
Design and Manufacturing	Closed Book, Calculator is not allowed.	Part I

1. What is the difference between “strength” and “stiffness” of a structure? (5%) Name one material property that describes the strength of the material. Name one material property that describes the stiffness of the material. (5%)
2. In the simple spur gear transmission shown below, the input power is 10kW @1750 rpm, pressure angle of the gears is 20° and the module m=1.5. Numbers of teeth of gear A and B are 20 and 60, respectively. Find the normal, radial and tangential forces of gear A and B. (Just list and explain the formulas, you don't have to compute the exact numbers.) (10%)



3. Draw a sketch to show the major components of a belt transmission and a chain transmission (4%). What situation is good for using belts transmission? (3%) What situation is good for using chains transmission? (3%)
4. A Bezier can be expressed by the following parametric equation:

$$\mathbf{P}(u) = \mathbf{P}_0(1-u)^3 + \mathbf{P}_1 3u(1-u)^2 + \mathbf{P}_2 3u^2(1-u) + \mathbf{P}_3 u^3, \quad 0 \leq u \leq 1$$

Assume the coordinates of the 4 control points are, $\mathbf{P}_0=(1, 3)$, $\mathbf{P}_1=(3, 5)$, $\mathbf{P}_2=(5, 4)$, $\mathbf{P}_3=(7, 1)$, draw the control polygon(5%). Plot 3 points on the curve at $u=0$, $u=0.5$, and $u=1$, and roughly plot the curve. (5%)

5. Point out what is wrong and make it correct in each sentence. (10%)
 - (1) The unit of Stress is $1 \text{ N/mm}^2 = 1\text{MPa}$, and the Young's modulus of steel is almost 207MPa ◦
 - (2) For brittle material, consider yielding strength S_y ; for ductile material, consider ultimate strength S_u .
 - (3) A structure design of airplane needs a very high safety factor.
 - (4) A structure does fracture under stress at first time, but fractures after the stress of periods of times. This is called “Stress Concentration”.
 - (5) When the chalk fractures under torsion, the fracture direction is at 45 degrees against the chalk axis. Because there is the maximum shear stress at 45 degrees.

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考試科目	方式	
Design and Manufacturing	Closed Book, Calculator is not allowed.	Part II

1. Please give description of the following mechanical properties (20%)
(i) toughness; (ii) hot hardness; (iii) strength to weight ratio; (iv) strain rate hardening
2. By what processes the following products made of and explain the process (30%)
(i) window frame; (ii) computer connector; (iii) plastic bottle; (iv) self-lubricating bearing