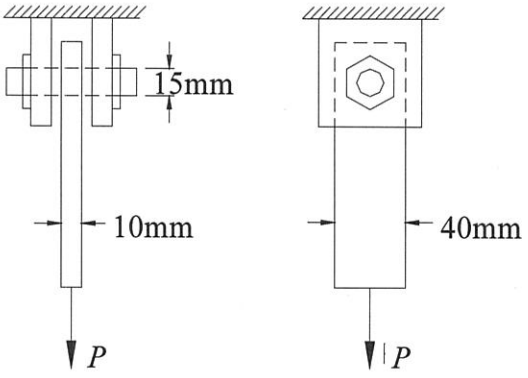
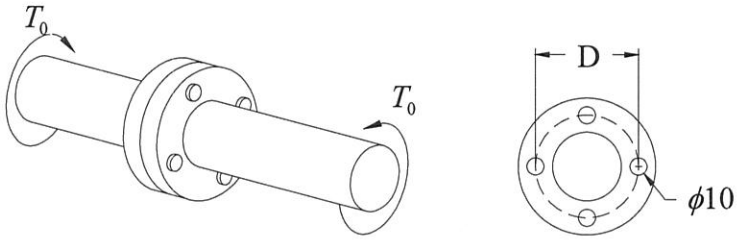
# 1011 機械系博士班資格考試題目

| 考試科目 | 方式 | |
|---|---|---|
| 設計製造 | **Closed Book, 不可使用計算機** | **Part I** |

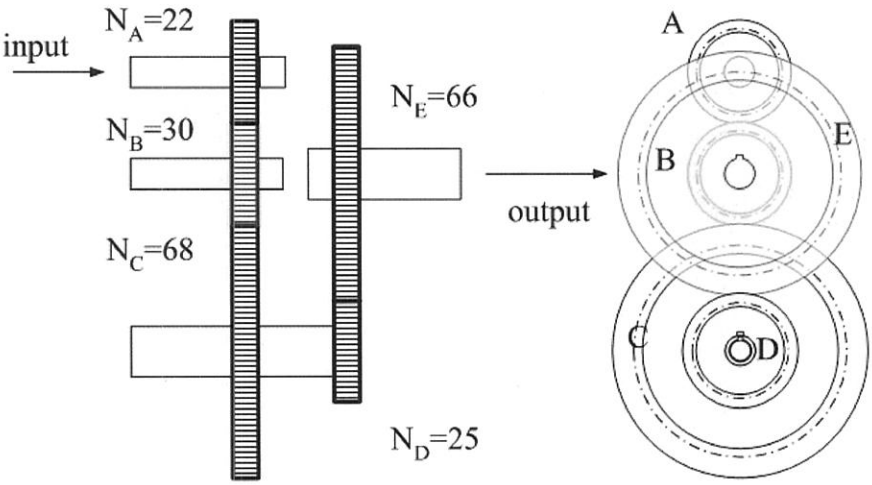
1. Calculate the direct shear stress in the pin and bolts in the following figures (5% each).




(a) P=500N (b) T0=100N m

2. In the simple spur gear transmission shown below, the input gear is A and output E, and the input power is 10kW@1750 rpm. Calculate the velocity ratio of the gear train(2%).Which gear is the idle gear, and what does it do? (2%) Neglecting the effect of friction, calculate the torque output and rotation speed at the gear E (6%).



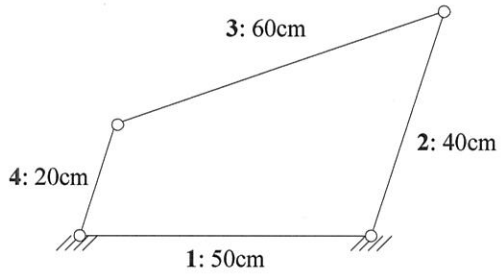
3. The bearing parameter relates to the coefficient of viscosity ($\mu$), rotational speed ($n$) and pressure of the lubricant inside the journal bearing ($p$). Draw a figure which relates the bearing parameter and coefficient of friction (4%). Indicate and explain "boundary lubrication", "mixed film lubrication", and "hydrodynamic lubrication" in this figure (6%).

4. The following figure is a simple four-bar linkage mechanism.

   (1) Why is the four-bar linkage mechanism so important? (4%)

   (2) Determine which link can rotate 360° by *Grashof's rule* (3%)

   (3) What is the name (type) of this mechanism? (3%)




5. A Bezier can be expressed by the following parametric equation:

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

   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%)

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1. (i)熱處理可以改變材料本身的哪兩種本質? (2.5%)
   (ii)熱處理可以改變材料的哪些機械性質? (2.5%)
   (iii)請說明“滲碳”表面處理的原理及效果? (2.5%)

2. 請說明以下兩種非破壞檢測方法的原理及目的
   (i)磁粉探傷法 (5%)
   (ii)超音波檢測法 (5%)

3. 請說明以下兩種非傳統加工製程原理及優缺點
   (i)放電加工(EDM) (5%)
   (ii)電化學加工(ECM) (5%)

4. (i)請簡述鑄造的基本製程 (2.5%)
   (ii)鑄造的缺點及優點? (5%)
   (iii)影響鑄造品質的因素有哪些? (5%)

5. (i)請簡述“快速成型”製程原理 (5%)
   (ii)請簡述“電子束焊接”原理 (5%)