

國立中央大學98學年度碩士班考試入學試題卷

所別：機械工程學系碩士班 乙組(製造與材料) 科目：機械材料及材料力學 共 2 頁 第 1 頁  
 \*請在試卷答案卷(卡)內作答

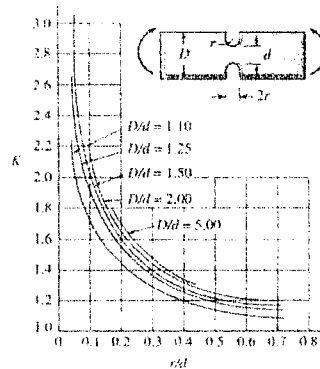
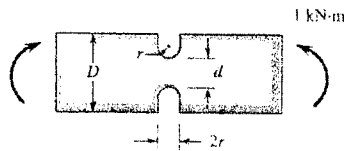
一、(50%)

In order to solve the problems, some formulas are given as follows for reference only.

$$\sigma = E\varepsilon \quad \tau = G\gamma \quad \sigma_x = -\frac{My}{I} \quad \tau_{xy} = \frac{VQ}{It} \quad \tau_\rho = \frac{T\rho}{J} \quad \delta = \frac{PL}{AE}$$

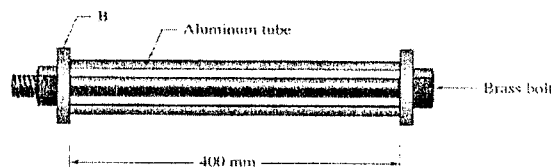
$$\phi = \frac{TL}{GJ} \quad EIy'' = M \quad V = \frac{dM}{dx} \quad q = \frac{dV}{dx} \quad Q = \int_A y dA \quad I = \int_A y^2 dA$$

- (10%) Define or explain the technical terms: (a) proportional limit, (b) elastic limit, (c) yield stress, (d) ultimate stress, and (e) Poisson's ratio.
- (10%) A flat bar is to have grooves cut into both edges. The whole depth of the bar is 120mm and the thickness is 12mm. The depth where the grooves are cut is required to be no less than 80mm, see the figure below. The allowable bending stress is 125MPa. The resisting moment is 1 kN-m. Determine the radius of the grooves.



Stress concentration factors  
for a flat bar in bending

- (10%) A brass of 10mm diameter is fitted inside an aluminum tube of 20mm outside diameter and 4mm wall thickness as shown in the figure. A nut is placed on the end of the bolt and is just bearing against the plate B. If the nut is then tightened on-half turn and the bolt is single thread with a 2.5-mm pitch (the pitch is the distance a bolt moves in a single revolution turn), determine the normal stress (a) in the bolt and (b) in the tube. Let  $E=105Gpa$  for the brass bolt and  $E=70Gpa$  for the aluminum tube.



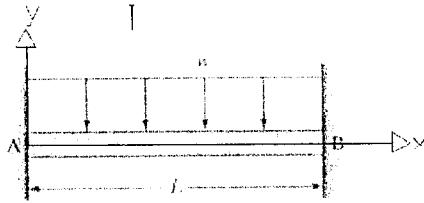
注意：背面有試題

參考用

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4. (20%) A fixed-fixed beam is subjected to the uniform load as shown in the figure below. Determine (a) the reactions, (b) the deflection expression using the integration method, (c) the expression for the state of stress at any point of the beam, and (d) the principal stresses and principal planes for a point at  $(L/2, h/2)$ . Let the rectangular cross-sectional area of the beam  $A = t \times h$  be constant.



二、(50%)

- 1.(15%)試述鐵碳系中的麻田散鐵相變化，及其應用於麻田散鐵強化方法之麻田散鐵強化機構。
- 2.(15%)解釋當單晶材料屈服於剪力作用時，產生滑動(slip)變形機制與孿晶(twin)變形機制的差異點。
- 3.(10%)說明為什麼金屬材料有良好的導電性、延展性及強度？造成絕緣材料和金屬材料的導電性相當大的差距原因為何？
- 4.(10%)金屬材料經冷加工後，造成微結構的改變有那些？在經冷加工後，會產生加工強化效應的原因？

參考用

注意：背面有試題