

國立臺灣科技大學
113學年度碩士班招生
試題

系所組別：0310機械工程系碩士班甲組

科 目：材料力學

<<503102>>



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 科目：材料力學

(總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分)

1. [50%] Please choose the best answer for each of the following multiple-choice questions.

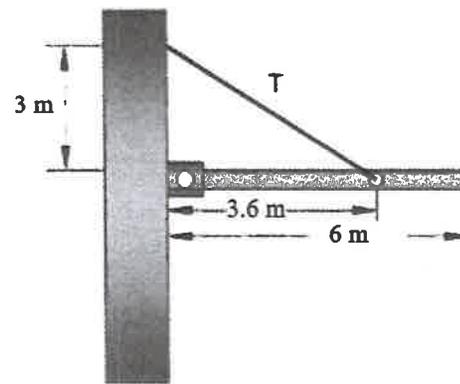
(本大題為選擇題，共 10 小題，每小題答對給 5 分，答錯給 0 分，共計 50 分。每小題請選擇一個最佳的答案，答案卷上請按順序寫清楚每小題所對應的答案，例如：

1. (i) A, (ii) A, (iii) A, ..., (ix) A, (x) A。

不必寫算式或理由等。本題 10 個小題的答案要寫在一起，不能中間穿插其他題目的答案。)

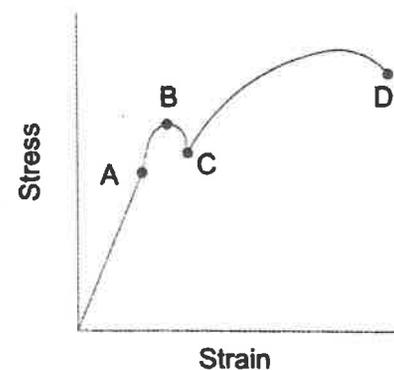
(i) [5%] A uniform beam of 100 N weight is supported by a tension cable. Dimensions are shown in the following diagram. What is the tension in the cable?

- (A) 100 N
 (B) 130 N
 (C) 160 N
 (D) 190 N



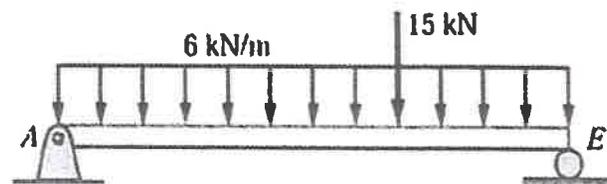
(ii) [5%] The following image is a stress-strain diagram for a steel material. Select the most truthful statement.

- (A) As the stress increases beyond point A, the material is inelastic.
 (B) From point B to point C, the material is elastic.
 (C) The ultimate tensile stress point is between points B and C.
 (D) Point D is referred to as the breaking point.



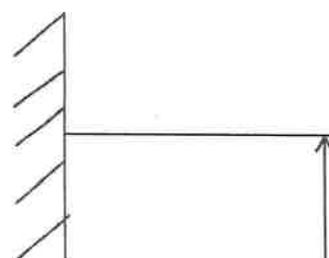
(iii) [5%] A beam with a uniform rectangular cross-section is subject to the loading shown below. The rectangular cross section has a height of 0.20 m and a width of 0.12 m. The maximum moment is 16 kN·m. What is the maximum bending stress in this beam?

- (A) 10 MPa
 (B) 20 MPa
 (C) 20 GPa
 (D) 33 MPa



(iv) [5%] The diagram depicts _____ kind of beam.

- (A) cantilever
 (B) continuous
 (C) overhanging
 (D) simply supported



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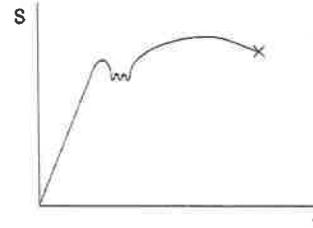
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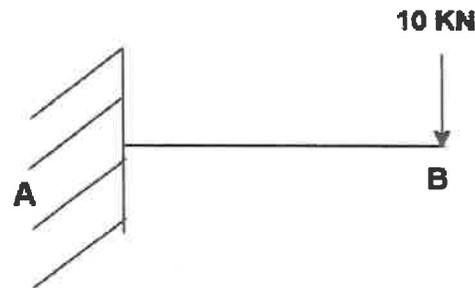
- (v) [5%] The figure shown represents the stress-strain relationship of which of the following materials? In the figure, S means stress and e means strain.

- (A) Cast iron
(B) Copper alloys
(C) Tungsten
(D) Mild steels



- (vi) [5%] What will be the variation in the bending moment diagram? [Assume that the length of the beam is 2 m].

- (A) Rectangular
(B) Trapezoidal
(C) Triangular
(D) Square

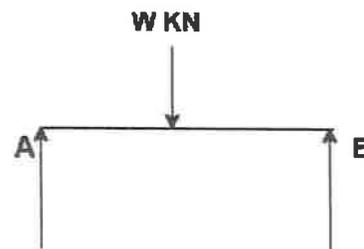


- (vii) [5%] The bending moment in a beam is maximum when the _____

- (A) shear force is minimum.
(B) shear force is maximum.
(C) shear force is constant.
(D) shear force is zero.

- (viii) [5%] Determine the maximum bending moment for the following figure. The length of the simply supported beam is L.

- (A) $wL/2$
(B) $wL/3$
(C) $wL/4$
(D) wL



- (ix) [5%] If a beam is subjected to pure bending, then the deformation of the beam is _____

- (A) arc of a circle.
(B) triangular.
(C) trapezoidal.
(D) rectangular.

- (x) [5%] The curvature of the beam _____ to the bending moment.

- (A) is directly proportional
(B) is equal
(C) is inversely proportional
(D) coincides

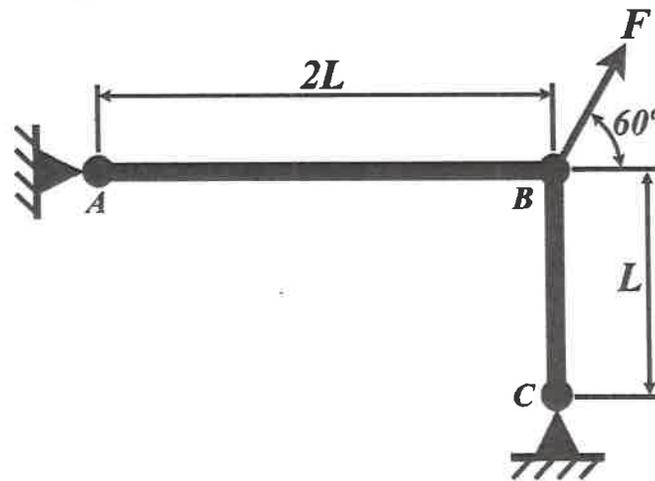


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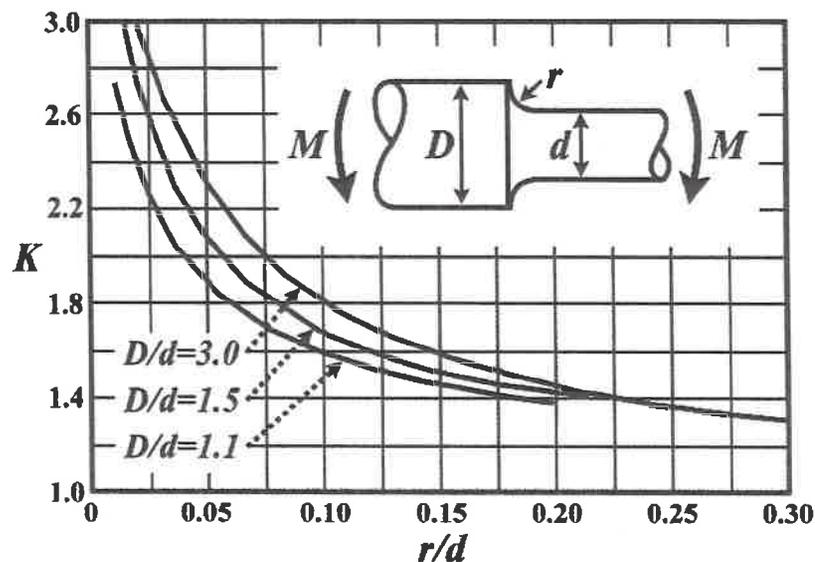
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2. [20%] Two bars AB and BC support a load F at joint B . These two bars have the same modulus of elasticity E and cross-sectional area A .
- (a) [10%] Determine the load of bar AB and bar BC .
- (b) [10%] Determine the strain energy of the two bars.



3. [15%] A stepped shaft consisting of solid circular segments is subjected to bending moments $M = 10 \text{ N}\cdot\text{m}$. One segment has a diameter of $D = 30 \text{ mm}$ and the other segment has a diameter of $d = 20 \text{ mm}$. The stepped shaft has a fillet of radius $r = 0.5 \text{ mm}$.
- (a) [5%] Find the stress concentration factor K for the stepped shaft.
- (b) [10%] Determine the maximum bending stress of the stepped shaft.



4. [15%] A tapered bar with solid square cross sections and length L has a modulus of elasticity E . The bar is subjected to loads F acting at the ends. Use the following data: $H_A = 20 \text{ mm}$, $H_B = 40 \text{ mm}$, $L = 100 \text{ mm}$, $E = 150 \text{ GPa}$, and $F = 5 \text{ kN}$. Determine the elongation of the bar.

