

# 國立中山大學 114 學年度 碩士班考試入學招生考試試題

科目名稱：科技英文【機電系碩士班戊組】

## —作答注意事項—

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，請衡酌作答。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶書籍、紙張（應考證不得做計算紙書寫）、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

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科目名稱：科技英文【機電系碩士班戊組】

題號：438007

※本科目依簡章規定「不可以」使用計算機(問答申論題)

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## A. Choice the Correct "One" Answer: (50%)

1. (5%) While riding a skateboard down a gentle slope, what type of friction should exist between the sidewalk and the skateboard wheels to minimize energy loss while still allowing control over the direction of motion?  
(A) No friction.  
(B) Only sliding friction.  
(C) Both static and sliding friction.  
(D) Only static friction.
2. (5%) When new tires are installed on a car, small weights are placed on the rim to balance the wheels. If one of these weights falls off, the car may shake violently when driven at specific speeds. This shaking happens because:  
(A) The vibrating wheel behaves like a harmonic oscillator.  
(B) The rotational kinetic energy of the wheel equals the car's translational kinetic energy, allowing resonant energy transfer.  
(C) The vibration frequency of the unbalanced wheel matches the car's natural vibration frequency, causing a resonant energy transfer.  
(D) The amplitude of the vibrating wheel becomes large enough to overcome the car's inertia.
3. (5%) You are in the kitchen with three mixing bowls: one made of metal, one of glass, and one of plastic. All three are at the same temperature of 68°F (20°C). If you touch the bowls together:  
(A) Heat will flow from the glass bowl to both the plastic bowl and the metal bowl.  
(B) Heat will flow from the plastic bowl to the glass bowl, and from the glass bowl to the metal bowl.  
(C) No heat will flow between the bowls.  
(D) Heat will flow from the metal bowl to the glass bowl, and from the glass bowl to the plastic bowl.
4. (5%) At sea level in Charlottesville, boiling an egg for 10 minutes results in a firm, "hard-boiled" egg. On the top of Mount Everest, at an altitude of 29,029 feet, an egg left in boiling water stays soft indefinitely. Why does the egg fail to cook on Mount Everest?  
(A) Water boils at low temperature when the air pressure is very low.  
(B) Water boils at low temperature when gravity is weak.  
(C) Water has poor thermal conductivity when its pressure is very low.  
(D) An egg cannot get very hot when gravity is weak.
5. (5%) While swimming at the beach, you move past the breaking surf to float among the waves. As each wave crest passes, how do you travel?  
(A) Vertically—directly up and then directly down.  
(B) Horizontally toward shore for a distance that's proportional to the slope of the wave crest.  
(C) In a circle—up, toward shore, down, and away from shore.  
(D) Horizontally toward shore for a distance equal to one wavelength of the passing wave.

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6. (5%) A child is playing on a swing. As long as the swing doesn't go too high, the time needed to complete one full oscillation is independent of:  
(A) The weight of the child, but not the amplitude of the motion.  
(B) Both the amplitude of the motion and the weight of the child.  
(C) Both the length of the ropes supporting the swing and the amplitude of the motion.  
(D) The amplitude of the motion, but not the weight of the child.
7. (5%) You are surfing on a large wave, positioned halfway up the front edge of the wave while moving steadily toward shore at a constant speed. What is the net force acting on you?  
(A) Zero.  
(B) Downhill—toward the trough in front of you.  
(C) Horizontal—toward the shore.  
(D) Uphill—toward the crest behind you.
8. (5%) A shoelace passes without friction through 5 holes on each side of your shoe. If the tension in the shoelace is 10 N, what is the total force exerted by the shoelace on the right side of your shoe?  
(A) 100 N  
(B) 10 N  
(C) 50 N  
(D) 25 N
9. (5%) You just got a corner office near the top of a high-rise building, but it becomes uncomfortably hot on sunny days, even when the weather outside is cool. To solve the problem, you cover the inside of the windows with aluminum foil. What effect does this have?  
(A) A reduction of radiative heat transfer since the shiny aluminum foil has a low emissivity.  
(B) A reduction of convective heat transfer.  
(C) A dark room that is just as hot as before you covered the windows.  
(D) A reduction of conductive heat transfer from the cool outside air to the warm room inside.
10. (5%) While mountain biking through the woods, you encounter a deep gully with a smooth, bowl-shaped bottom. Neglecting friction and air resistance, you coast down one side and back up the other without pedaling. When you are at the bottom of the gully, how do you feel?  
(A) Heavier than normal since you are accelerating upward.  
(B) Lighter than normal since you are accelerating upward.  
(C) No heavier or lighter than normal since you are not accelerating at the bottom.  
(D) Heavier than normal since you are accelerating downward.

## B. Explain the following concepts: (20%)

1. (10%) Can you explain the distinction between engineering stress and true stress in terms of their definitions and how they are calculated?
2. (10%) Can you explain the difference between the stress-strain relationships for elastic and plastic behavior in a ductile material?

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## C. Determine the correct answer for the question provided below. (30%)

1. (10%) Determine the location of the roller support, expressed as the distance  $a$  as a fraction of the beam's length  $L$ , to ensure that the moment at point  $B$  is zero as shown in **Fig. 1**.  
 (A)  $a = \frac{L}{3}$ ; (B)  $a = \frac{L}{6}$ ; (C)  $a = \frac{3L}{8}$ ; (D)  $a = \frac{5L}{128}$
2. (10%) Calculate the moment of inertia of the shaded region with respect to the  $x$ -axis as depicted in **Fig. 2**.  
 (A)  $614 \text{ m}^4$ ; (B)  $307 \text{ m}^4$ ; (C)  $921 \text{ m}^4$ ; (D)  $1228 \text{ m}^4$

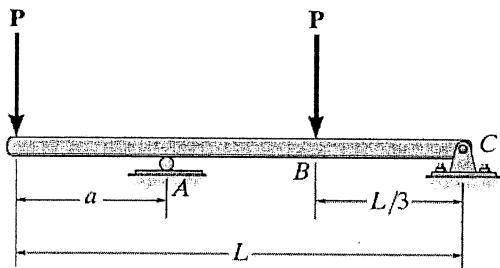


Fig. 1

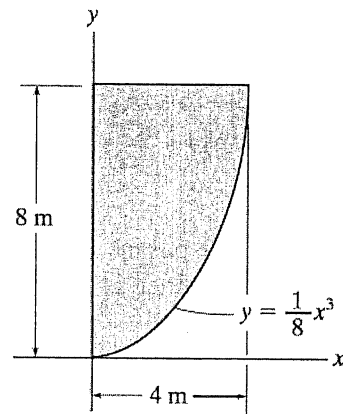


Fig. 2

3. Using the stress-strain diagram provided in **Fig. 3** for a steel alloy:
  - (a) (4%) Determine the modulus of elasticity,  $E$ , using the linear region of the curve.
  - (b) (3%) Calculate the yield strength ( $\sigma_{YS}$ ) based on a 0.2% strain offset.
  - (c) (3%) Identify the ultimate tensile stress ( $\sigma_u$ ) and the fracture stress ( $\sigma_f$ ) as shown on the graph.

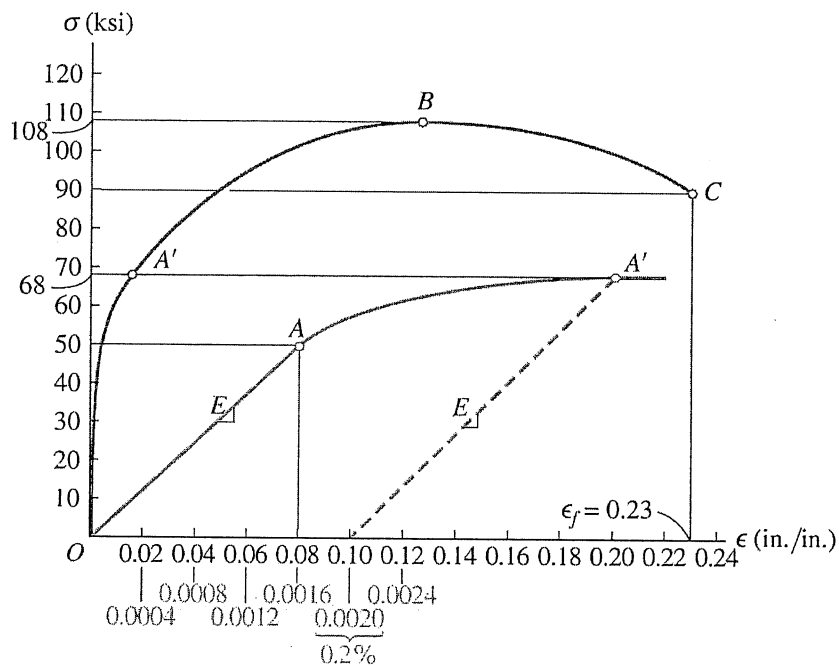


Fig. 3