

系所組別：工程科學系丁、戊組

考試科目：工程力學

考試日期：0223，節次：1

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

## 靜力學部分

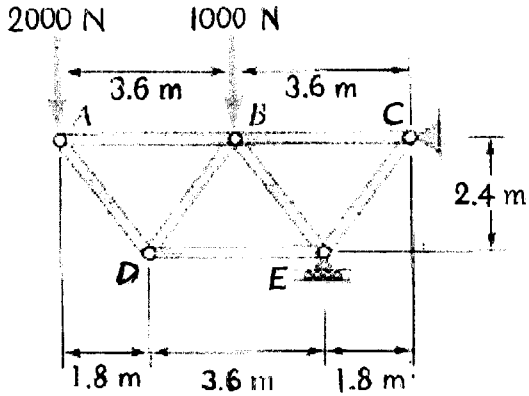
注意：靜力學共有七題，第一到第五題，每題只有一個答案，第六、第七題為計算題。批改人員將只核對每題的最後答案，計算或誘導過程不必列出。請考生將每題的答案（若有單位請包含單位）以方框標註出來，以利批改考卷。

1. (4%) A certain vector in the  $xy$  plane has an  $x$  component of 4 m and a  $y$  component of 10 m. It is then rotated in the  $xy$  plane so its  $x$  component is doubled. Please determine its new  $y$  component.
2. (4%) Two vectors lie with their tails at the same point. When the angle between them is increased by  $20^\circ$  their scalar product has the same magnitude but changes from positive to negative. What was the original angle between them?
3. (4%) A 40-N crate rests on a rough horizontal floor. A 12-N horizontal force is then applied to it. If the coefficients of friction are  $\mu_s = 0.5$  and  $\mu_k = 0.4$ , determine the magnitude of the frictional force on the crate.
4. (4%) A horizontal force of 5.0N pushes a 0.5-kg book against a vertical wall. The book is initially at rest. If the coefficients of the friction are  $\mu_s = 0.6$  and  $\mu_k = 0.8$ , determine the magnitude of the frictional force.
5. (4%) A 5.0-kg crate is resting on a horizontal plank. The coefficient of static friction is 0.5 and the coefficient of kinetic friction is 0.4. After one end of the plank is raised so the plank makes an angle of  $30^\circ$  with the horizontal, what is the force of friction?

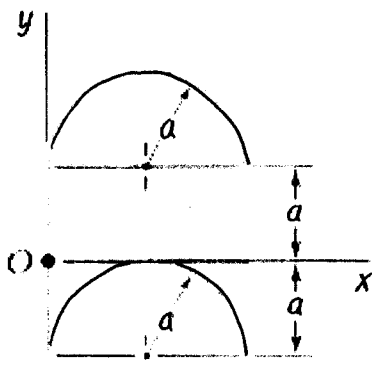
(背面仍有題目，請繼續作答)

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6. (18%) Determine the force in members  $BC$ ,  $BD$ , and  $BE$  of the truss shown.



7. (12%) Determine the moments of inertia of the shaded area shown with respect to the  $x$  and  $y$  axes.



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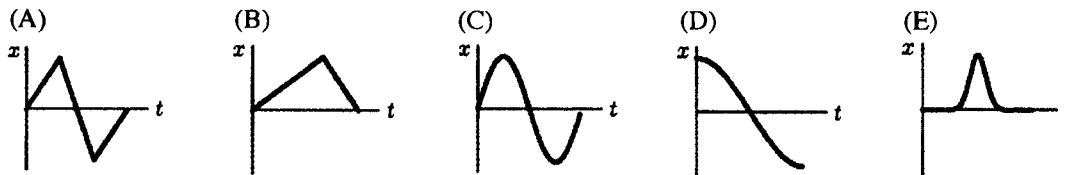
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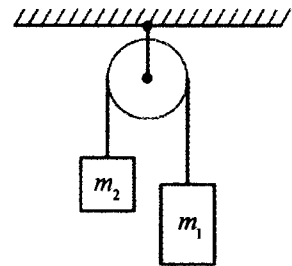
注意：第8至第14題為動力學部分，每題只有一個答案。批改人員將只核對每題的最後答案，計算或誘導過程不必列出。若你有列出計算或誘導過程，請將每題的最後答案（若有單位請包含單位）以方框標註出來，以利批改作業。

8. (5%) A ball is dropped from a height of  $H$  above a floor and rebounded up to a height of  $R$ . What is the coefficient of restitution between the ball and the floor?

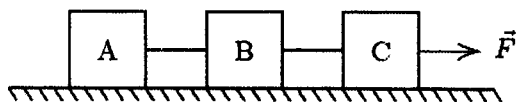
9. (5%) A car accelerates from rest on a straight road. A short time later, the car decelerates to a stop and then returns to its original position in a similar manner, by speeding up and then slowing to a stop. Which of the following five coordinate versus time graphs best describes the motion?



10. (5%) Two blocks of mass  $m_1$  and  $m_2$  ( $m_1 > m_2$ ) are connected by a string and a pulley as shown. Assuming that the string and the pulley are massless, and neglecting all the frictions, what is the magnitude of the acceleration of the blocks?



11. (5%) Three blocks, each having mass  $m$ , are connected by strings as shown. Block C is pulled to the right by a force of magnitude  $F$  that causes the entire system to accelerate. Neglecting friction and the mass of the strings, what is the magnitude of the net force acting on block B?



(背面仍有題目，請繼續作答)

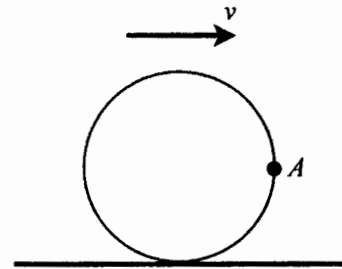
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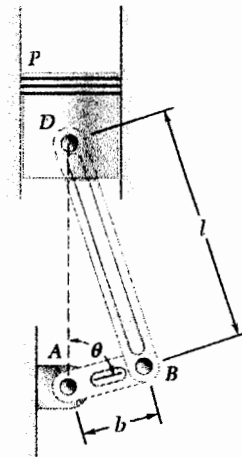
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12. (5%) An automobile travels to the right at a constant speed of  $v$ . What is the magnitude of the velocity of the point  $A$  on the rim of the wheel?



13. (10%) In the engine system shown, knowing that the crank  $AB$  rotates with a constant angular velocity of  $\omega$  clockwise, what is the magnitude of the angular velocity of the connecting rod  $BD$  when  $\theta = 0$ ?



14. (15%) A bullet of mass  $m_0$  is fired with a horizontal speed  $v_0$  into the lower end of a slender bar of mass  $m$ . Knowing that  $h = 0$  (i.e.,  $A$  coincides with  $C$ ) and the bar is initially at rest, what is the magnitude of the angular velocity of the bar immediately after the bullet becomes embedded?

