

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：應用力學【機電系碩士班丙組】

題號：438007

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）

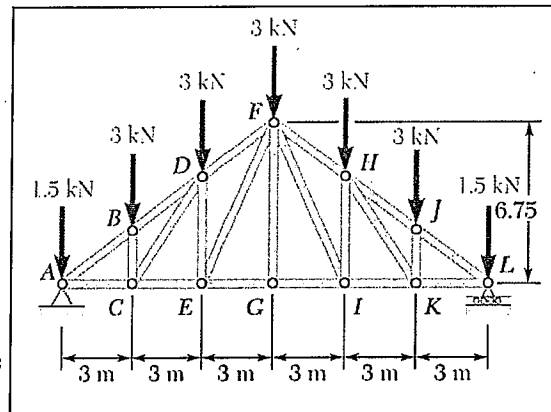
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Please choose the correct answers for problems 1 and 2.

Please be noted that the correct answers for each problem may be more than one (複選題)

1. Consider a truss is loaded as shown, then which of the following statements are correct? (25 %)

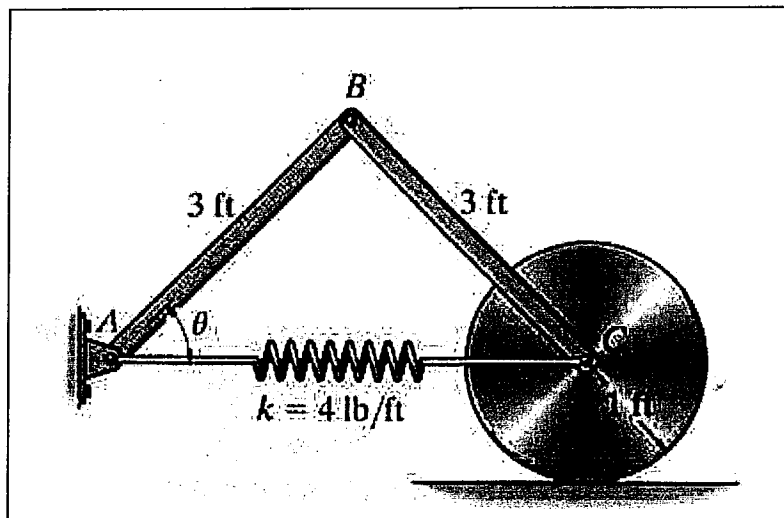
- (A) The magnitude of member CE is between 7.5 kN and 8.5 kN and is subjected to a tensile force.
- (B) The magnitude of member FI is between 3.5 kN and 4.5 kN and is subjected to a compressive force.
- (C) There is only one zero-force member in the loaded truss as shown.
- (D) If the external loadings acting on the joints A, B, D, H, J, L were removed, then there are nine zero-force members in the truss.
- (E) If the external loadings acting on the joints A & B were removed, then member AB is a zero-force member.
- (F) None of the previous statements is correct.



2. A 200-kg space vehicle is observed at $t = 0$ to pass through the origin of a Newtonian reference frame Oxyz with velocity $\mathbf{v}_0 = (150 \text{ m/s}) \mathbf{i}$ relative to the frame, where $[\mathbf{i}, \mathbf{j}, \mathbf{k}]$ are the base unit vectors of the Newtonian reference frame Oxyz. Following the detonation of explosive charges, the vehicle separates into three parts A, B, and C, of mass 100 kg, 60 kg and 40 kg, respectively. Knowing that 'at $t = 2.5 \text{ s}$ the positions of parts A and B are observed to be A (555, -180, 240), and B (255, 0, -120) where the coordinates are expressed in meters. It is also known that at $t = 2.5 \text{ s}$, the velocity of part A is $\mathbf{v}_A = (270 \text{ m/s}) \mathbf{i} - (120 \text{ m/s}) \mathbf{j} + (160 \text{ m/s}) \mathbf{k}$ and the velocity of part B is parallel to the xz plane. Then, which of the following statements are correct? (25 %)

- (A) The mass center of parts A, B, and C is travelling with constant acceleration 9.81 m/s^2 .
- (B) Both of the position vector and velocity vector of the mass center of parts A, B, and C are perpendicular to the yz plane of the frame Oxyz.
- (C) At $t = 2.5 \text{ s}$, the position of part C is (105, 450, 420) m.
- (D) At $t = 2.5 \text{ s}$, the velocity of part C is $(-30 \text{ m/s}) \mathbf{i} + (300 \text{ m/s}) \mathbf{j} + (280 \text{ m/s}) \mathbf{k}$
- (E) In this problem, both of the total linear momentum and total angular momentum about origin O of the system are conservative.
- (F) None of the previous statements is correct

3. The assembly consists of two 15-lb slender rods and a 20-lb disk. If the spring is unstretched when $\theta = 45^\circ$ and the assembly is released from rest at this position, determine the angular velocity of rod AB at the instant $\theta = 0^\circ$. The disk rolls without slipping. (限用功能原理為主來計算) (25 %)



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4. The Charpy impact test is used in materials testing to determine the energy absorption characteristics of a material during impact. The test is performed using the pendulum, which has a mass m , mass center at G , and a radius of gyration k_G about G . Determine the distance r_p (in terms of k_G and \bar{r}) from the pin at A to the point P where the impact with the specimen S should occur so that the horizontal force at the pin at A is essentially zero during the impact. For the computation, assume the specimen absorbs all the pendulum's kinetic energy during the time it falls and thereby stops the pendulum from swinging when $\theta = 0^\circ$. (25 %)

