國立中山大學 113 學年度
碩士班暨碩士在職專班招生考試試題

科目名稱：應用力學(含靜力學及動力學)【機電系碩士班乙組】

All figures are for illustrative purposes only and not to scale.

1. **(20%)** The object shown in **Figure 1** contains three subblocks; **determine the coordinates of the object's centroid.** The object is homogenous. The unit of length is millimeter, round to the second decimal place.
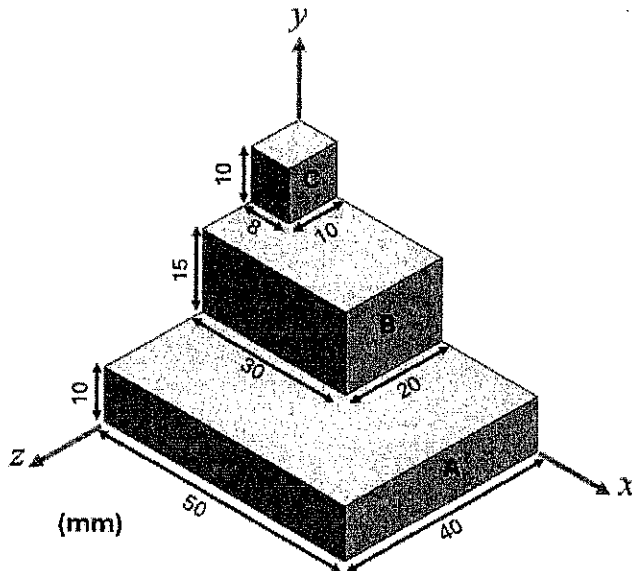

Figure 1

2. **(20%)** A bracket in **Figure 2** is attached with three cables. The cables exert three forces on the bracket. F_1 is on the xy plane, F_2 is on the xz plane, and F_3 is toward the negative z direction. Neglect the thickness of the bracket, **replace the forces with an equivalent force-couple system at point D.** Use newton (N) and meter (m) for the units of the answers. Use **i**, **j**, **k** for the unit vectors with respect to x, y, z coordinates. (10% for the force and 10% for the couple)
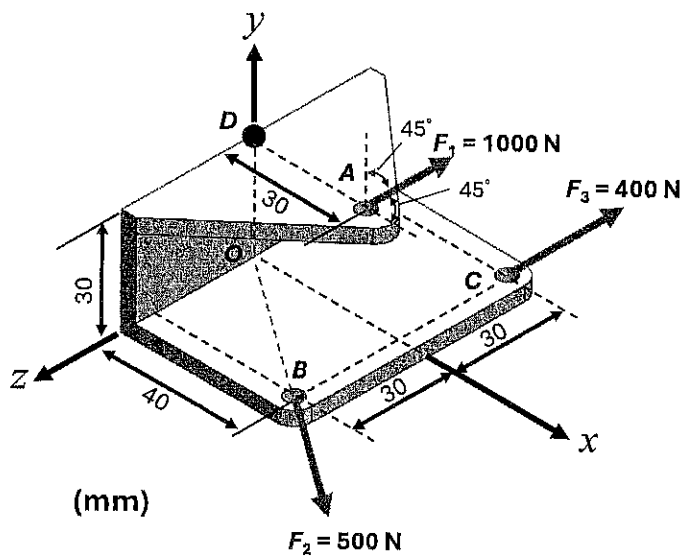

Figure 2

3. **(20%)** As shown in **Figure 3**, in the beginning, block A is sliding to the right with a speed of 13 m/s, and ball B is resting at the edge of the step. The distance between block A and ball B is 10 m. After an *elastic* collision, ball B falls to point B' as shown in the figure. Block A is 5 kg, and ball B is 10 kg. Neglect the volumes of the block and the ball, **determine the distance that block A slides after collision.** ($g = 9.8$ m/s²)
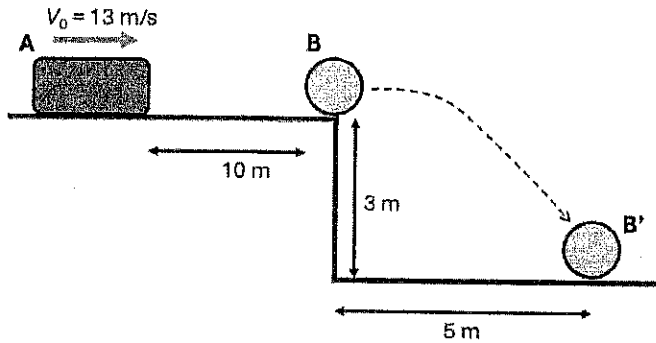

Figure 3

4. **(20%)** An 18-kg slender rod is attached to a spring with an unstretched length of 5 m. In the beginning, when $\theta = 30°$, the rod has an angular velocity of 3 rad/s CW. Determine the angular velocity of the rod when $\theta = 90°$. ($g = 9.8$ m/s²)
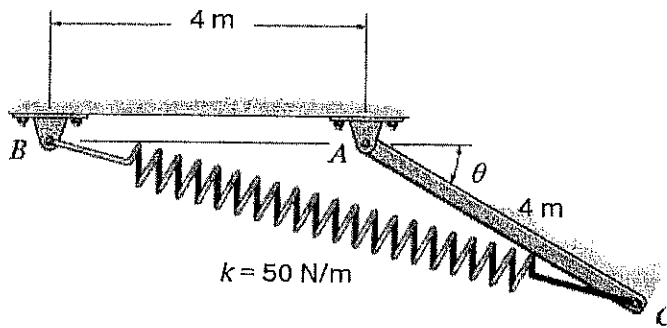

Figure 4

5. **(20%)** The plate gears A & B in **Figure 5** rotate with the angular velocities as shown. Determine:
   (1) (10%) The angular velocity of gear C about the shaft DE.
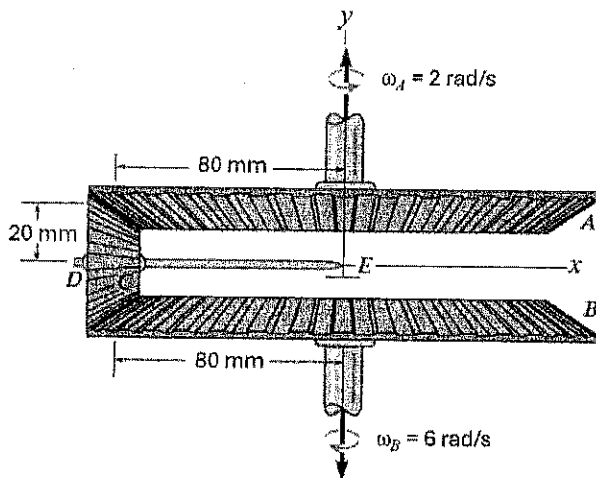   (2) (10%) The angular velocity of DE about the y-axis.

Figure 5