

國立臺灣科技大學  
九十學年度碩士班招生考試試題

系所組別：機械工程系乙組  
科目：材料力學

1. Construct the shear-force and bending-moment diagrams for beam ABC as shown in Figure 1. The beam is loaded by a weight  $W=10.0$  kN applied through a cable. The cable passes over a small frictionless pulley at C and is attached to a vertical arm at D. (25%)
2. A two-axle carriage that is part of an overhead traveling crane in a testing laboratory moves slowly across a simple beam AB as shown in Figure 2. The load transmitted to the beam from the front axle is 2400 N and from the rear axle is 4800 N. The weight of the beam itself may be disregarded. Determine the minimum required section modulus  $S$  for the beam if the allowable bending stress is 120 MPa, the length of the beam is 16 m, and the wheelbase of the carriage is 5 m. (25%)
3. A horizontal bracket ABC shown in Figure 3 consists of two perpendicular arms AB and BC, the latter having a length of 0.4 m. Arm AB has a solid circular cross section with diameter equal to 60 mm. At point C a load  $P_1 = 2$  kN acts vertically and a load  $P_2 = 3$  kN acts horizontally and parallel to arm AB. Considering only the forces  $P_1$  and  $P_2$ , calculate the maximum tensile stress  $\sigma_t$ , the maximum compressive stress  $\sigma_c$  and the maximum in-plane shear stress  $\tau_{max}$  at point p, which is located at support A on the side of the bracket at midheight. (25%)
4. A cantilever beam AB of length  $L$  has a fixed support at A and a spring support at B as shown in Figure 4. The spring behaves in a linearly elastic manner with stiffness  $k$ . If a uniform load of intensity  $q$  acts on the beam, what is the downward displacement  $\delta_B$  of end B of the beam? (25%)

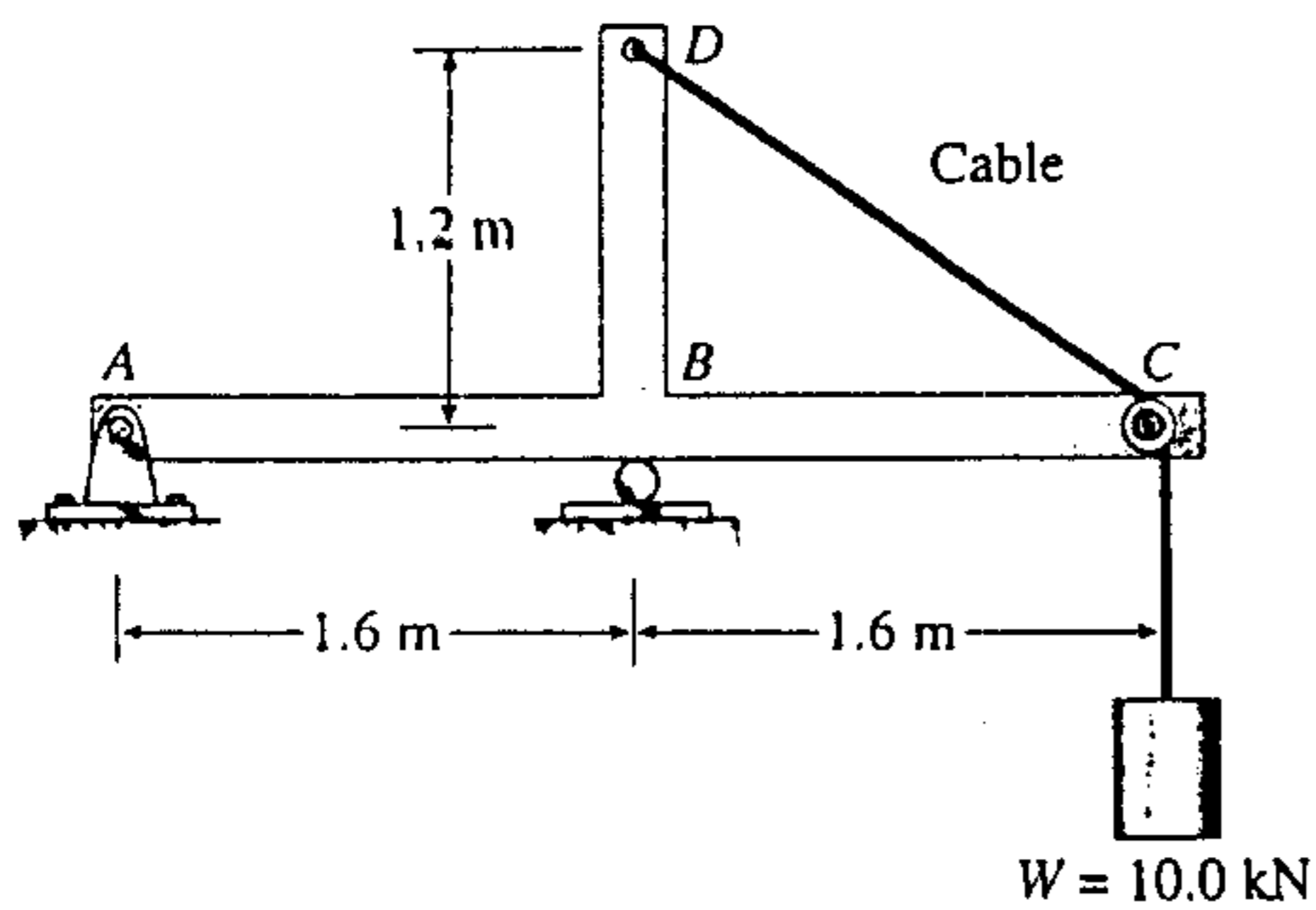


Fig. 1

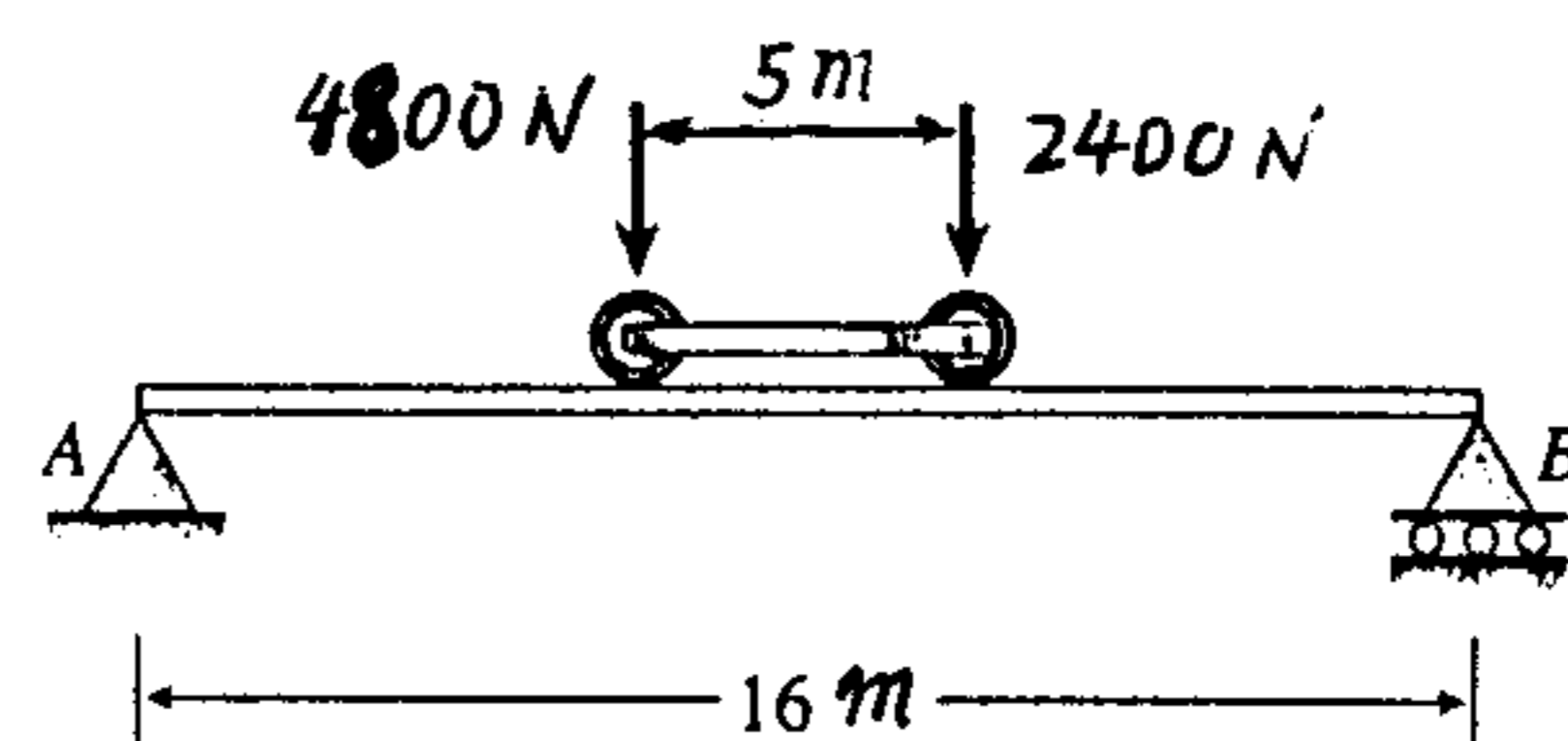


Fig. 2

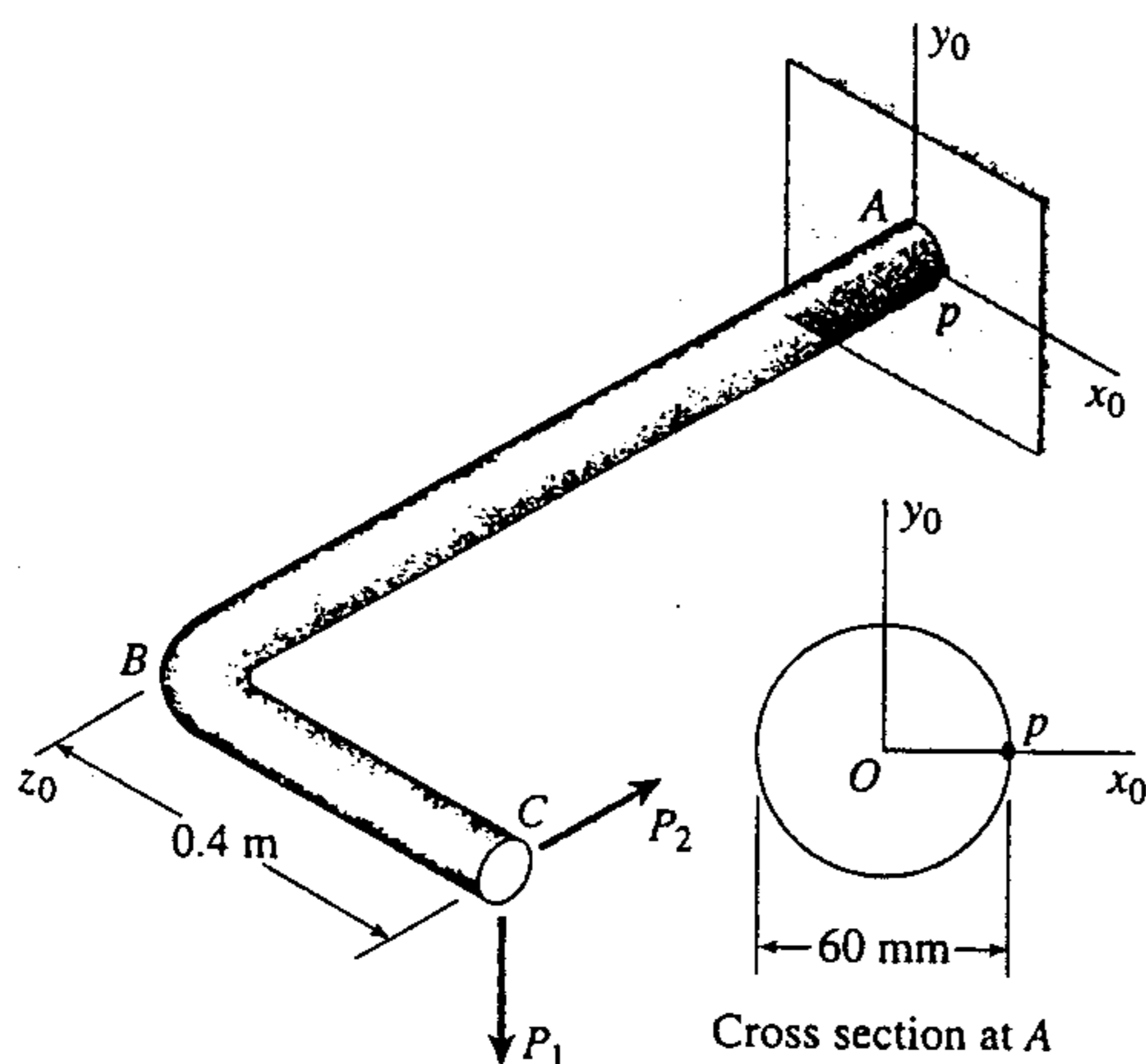


Fig. 3

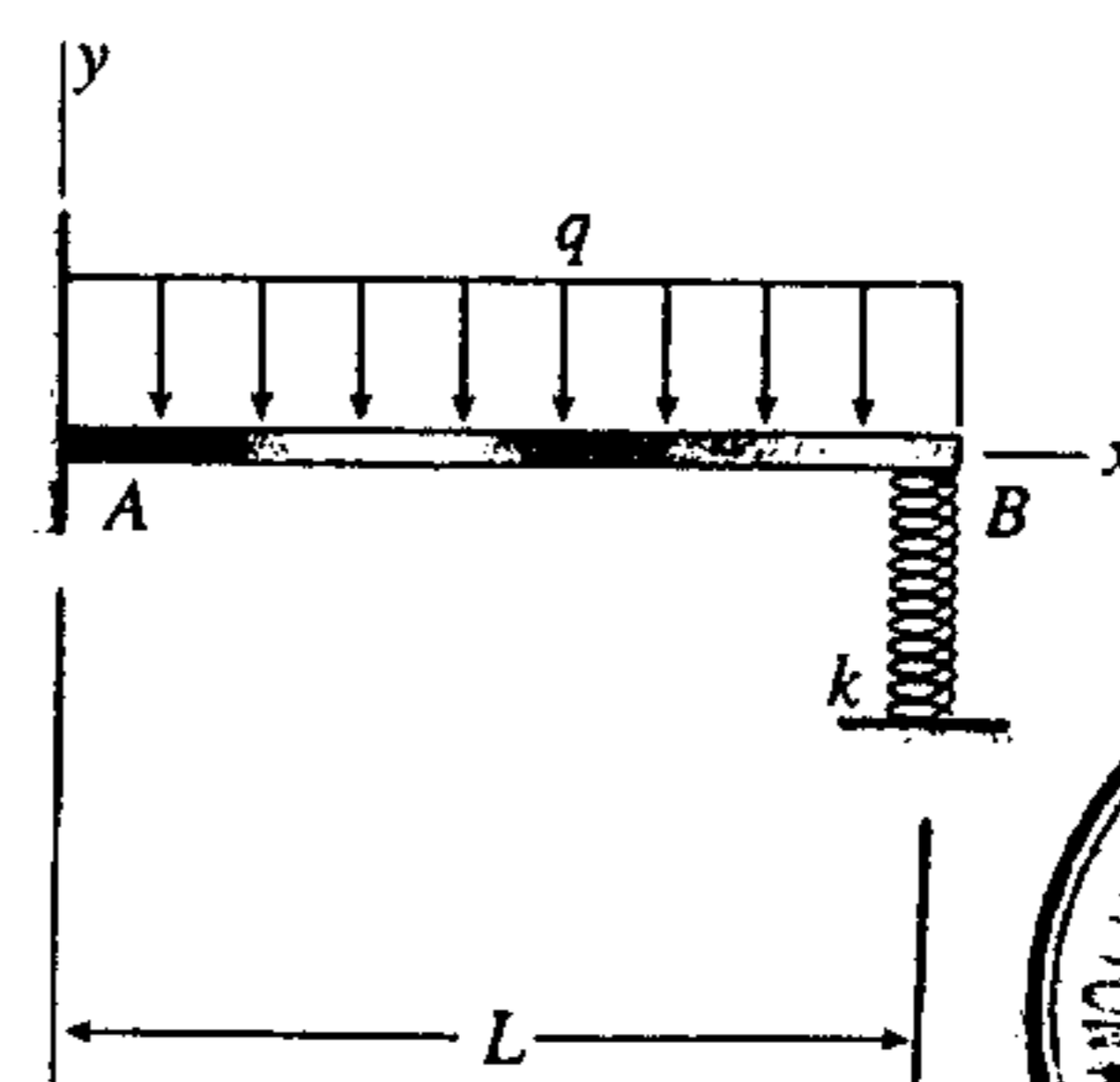


Fig. 4

