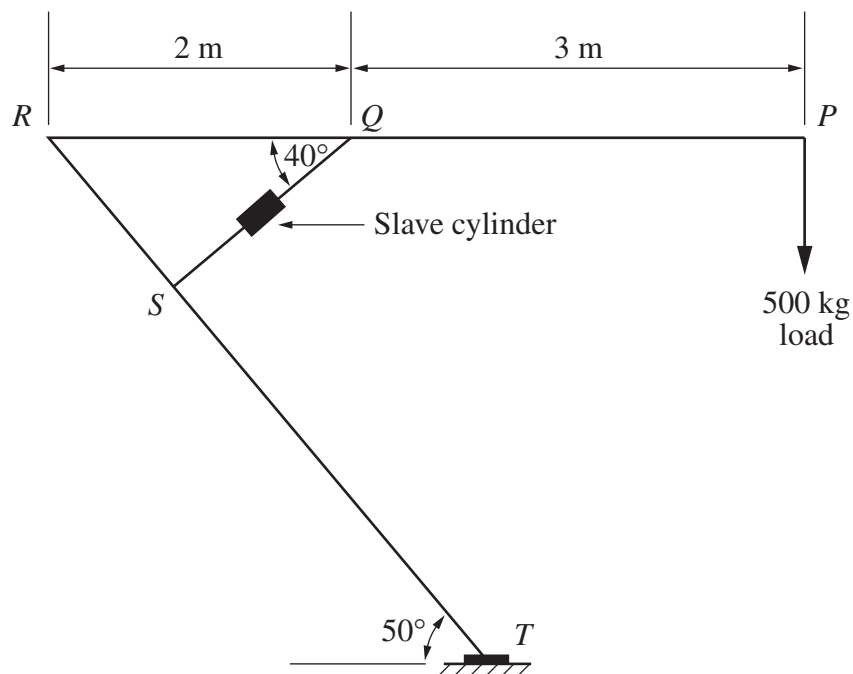


Question 14 — Lifting Devices (10 marks)

The diagram shows a lifting device. Arm RP is raised or lowered by a hydraulic system comprising a master cylinder and a slave cylinder.



- (a) The lifting device is required to hold a load of 500 kg. Determine the minimum force required in member QS to keep arm RP horizontal. 2

Minimum force =

Question 14 continues on page 19

Question 14 (continued)

(b) For another set of conditions, the force in member QS was found to be 21.35 kN.

- (i) Draw the shear-force diagram for the arm RP . Label the values on the diagram. The mass of the arm should not be considered. **2**



- (ii) Determine the diameter of the master cylinder if the mechanical advantage of the hydraulic system is 3. The slave cylinder has a cross-sectional area of 2800 mm^2 . **3**

Diameter =

Question 14 continues on page 20

Question 14 (continued)

- (c) Gears used in lifting devices can be manufactured by powder-forming or by a variety of other processes. **3**

Identify an alternative manufacturing process, and contrast the properties of gears formed by this process with the properties of the powder-formed gears.

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End of Question 14