Second Semester Examination
2022/2023 Academic Session

July / August 2023

EMM 102 – Statics
(Statik)

Duration: 3 hours
(Masa: 3 Jam)

Please check that this examination paper consists of FIVE (5) pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi LIMA (5) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer ALL **SIX (6)** questions.

*[**Arahan**: Jawab SEMUA **ENAM (6)** soalan]*

1. Collars A and B are connected by a 30 cm long wire and can slide freely on frictionless rods, as shown in Figure 1.

   (a) If a 75 N force Q is applied to collar B and the distance *x* is 12 cm, determine the tension in the wire and the corresponding magnitude of the force P required to maintain the equilibrium of the system.

   (60 marks)

   (b) If forces P is 125 N and Q is 80 N, determine the distances *x* and *z* for which the equilibrium of the system is maintained.

   (40 marks)

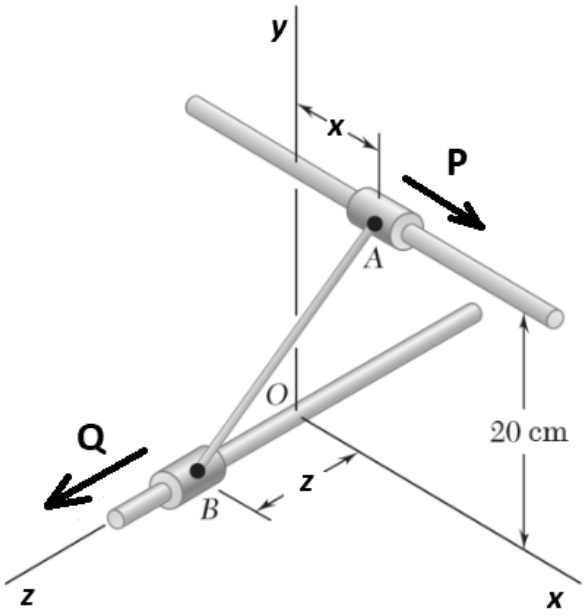

Figure 1

2. Three children are standing on a 5x5 meter raft, as shown in Figure 2. The weights of the children at point A, B and C are 375 N, 285 N and 420 N, respectively. Neglect the weight of the raft.

   (a) Determine the magnitude and the point of application of the resultant of the three children weights.

   (60 marks)

   (b) If a fourth child of weight 430 N climbs onto the raft, determine where she should stand if the line of action of the resultant of the four weights is to pass through the center of the raft.

   (40 marks)

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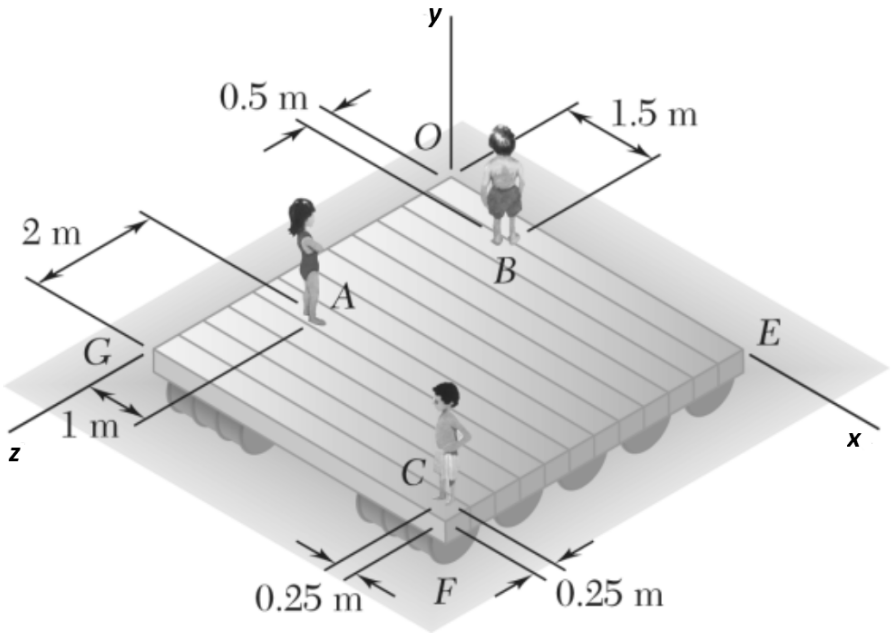

Figure 2

3. (a) The bearings at A, B and C do not exert moment on the bar and do not exert force in the direction of the axis of the bar, as shown in Figure 3 (a). Determine the reactions at the bearings due to the two forces on the bar.

(50 marks)

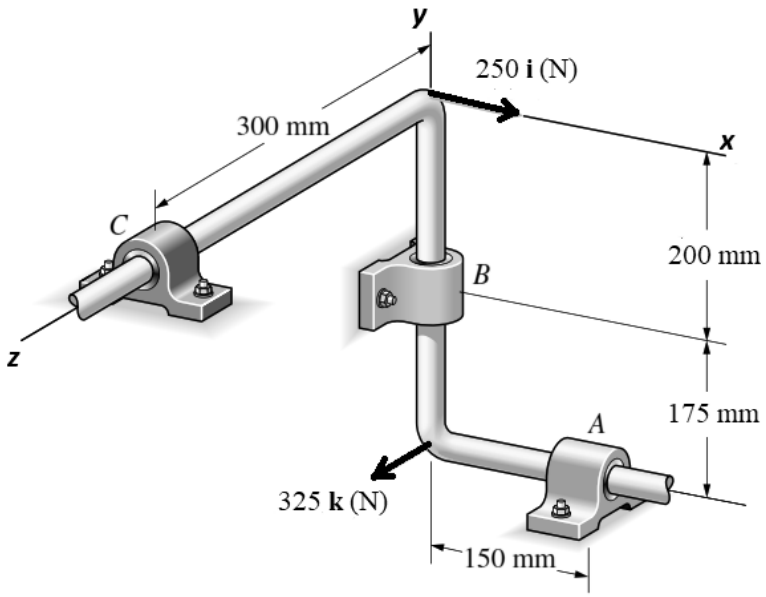

Figure 3 (a)

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(b) The crate in Figure 3 (b) has a weight of 130 kg and the coefficient of static friction at all contacting surfaces is $\mu_s = 0.3$. Determine the smallest horizontal force P required to pull out the wedge. Neglect the weight of the wedge.

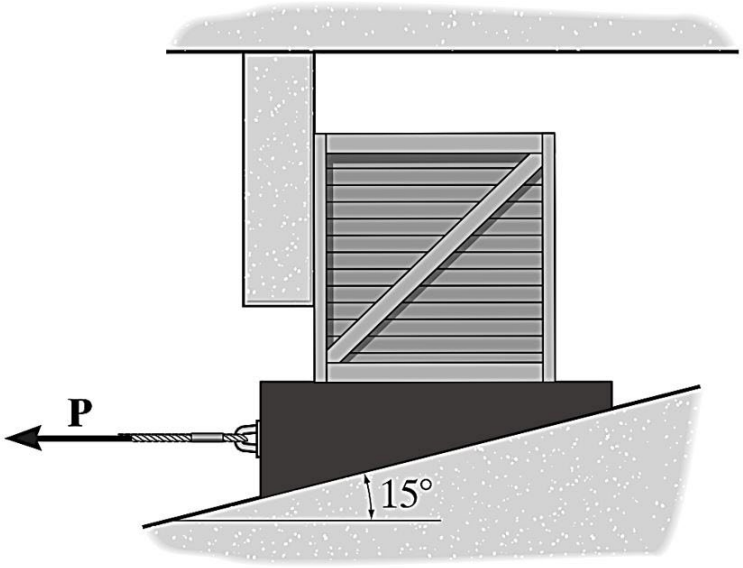

Figure 3 (b)

(50 Marks)

4. Determine the force in each member of the truss shown in Figure 4. State whether each member is in tension or compression.

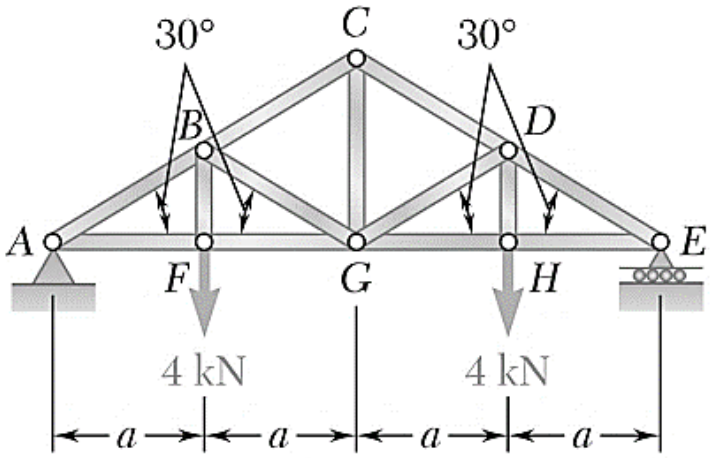

Figure 4

(100 Marks)

5. Calculate the $\bar{y}$ centroid of the shaded area shown in Figure 5. Then, calculate the moment of inertia of the shaded area about the x'–x' axis. Given:

   a = 8 cm
   b = 13 cm
   c = 20 cm
   r = 5 cm
   R = 13 cm

   (Please note that the figure is not drawn to scale).

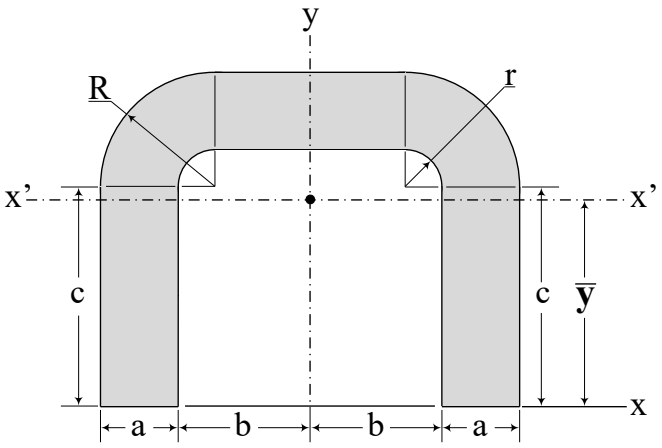

Figure 5

(100 marks)

6. The three steel rods, AB, AC and AD, each of cross sectional areas of 250 mm^2, jointly support the 7.5 kN load (Figure 6). Assuming that there was no slack or stress in the rods before the load was applied, determine the force in each rod. Use E = 200 GPa for steel.

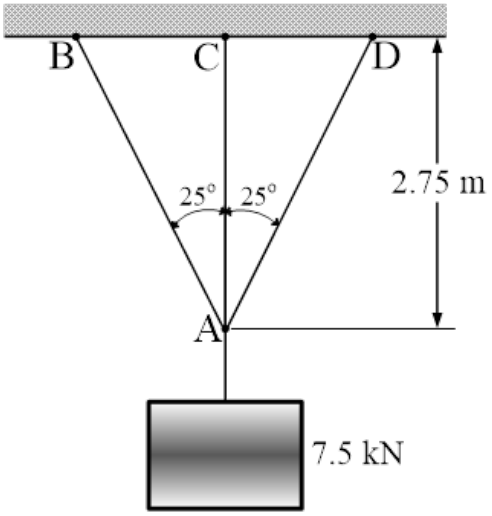

Figure 6

(100 marks)

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