Second Semester Examination
2020/2021 Academic Session

July/August 2021

EMM 102 – Statics

Duration: 2 hours

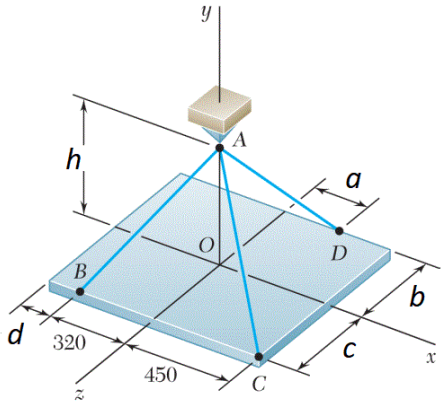
Please check that this examination paper consists of **SEVEN (7)** pages including appendixes before you begin the examination.

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

Answer to each question must begin from a new page.

1. [a] A rectangular plate is supported by three cables shown. Knowing that the tension in the cable AC is {T} N, determine the weight of the plate. Given that *a* is {a} mm, *b* is {b} mm, *c* is {c} mm, *d* is {d} mm and *h* is {h} mm.

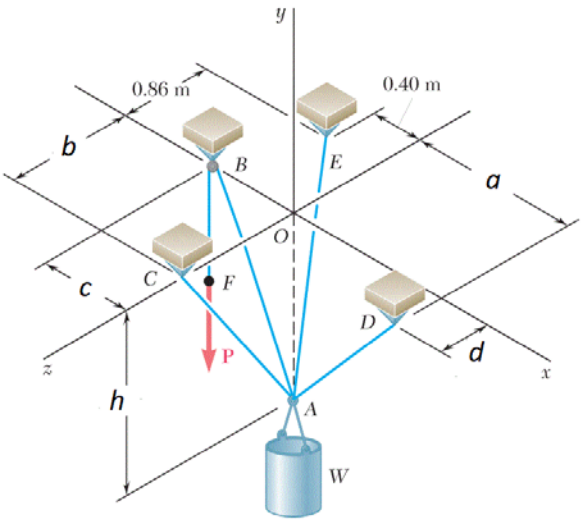
T=100-250, a=200-350, b=350-380, c=330-350, d=120-150, h=450-550



Dimensions in mm

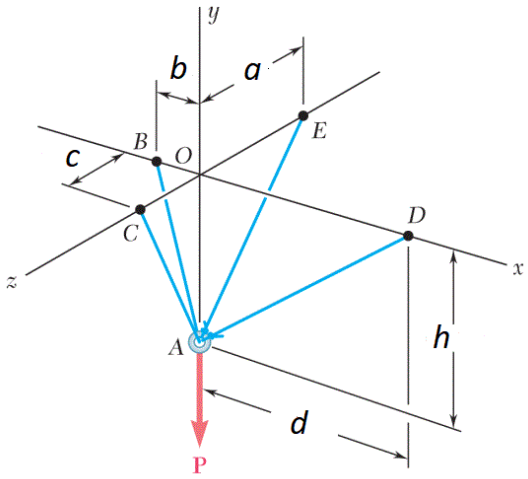
[b] A container of weight {W} N is suspended at ring A. Cables AC and AE are both tied to the ring and are attached to supports at C and E, respectively. The third cable is attached to a support at D, passes through frictionless ring at A and a frictionless pulley at B. Determine the magnitude of vertical force P to be applied at F to maintain the equilibrium. Given that *a* is {a} m, *b* is {b} m, *c* is {c} m, *d* is {d} m and *h* is {h} m.

W=800-1600, a=1-1.5, b=1-1.4, c=0.6-0.9, d=0.2-0.5, h=1.2-2.2



[c] Cable BAC passes through a frictionless ring A and is attached to fixed supports at B and C. Cables AD and AE are both tied to the ring and are attached to supports at D and E, respectively. A vertical load P of {P} N is applied to ring A, determine the tension in each of the three cables. Given that *a* is {a} cm, *b* is {b} cm, *c* is {c} cm, *d* is {d} cm and *h* is {h} cm.

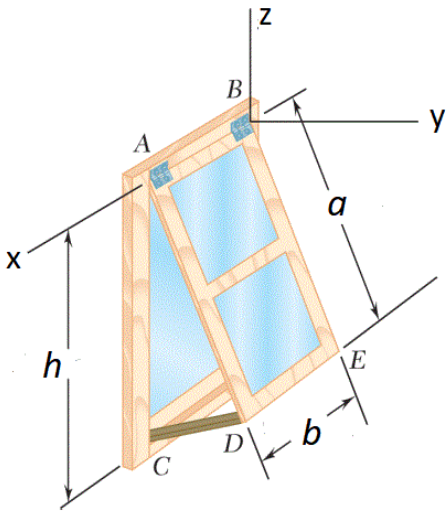
P=400-900, a=35-55, b=15-20, c=20-30, d=65-95, h=45-90



(100 marks)

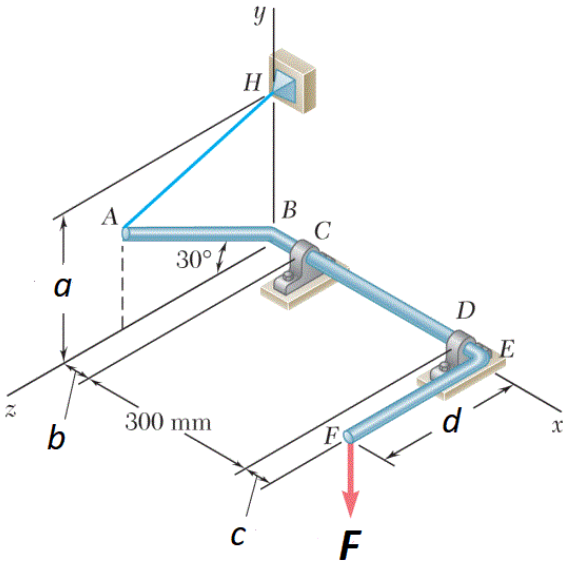
2. [a] A {m} kg storm window measuring {a} x {b} mm is held by hinges at A and B. In the position shown, it is held away from the side of the house by a {L} mm stick CD. Assuming that the hinge at A does not exert any axial thrust, determine the magnitude of the force exerted by the stick and the components of the reactions at A and B. Given that *a* is {a} mm, *b* is {b} mm and *h* is {a} mm.

m=10-20, L=500-700, a=1400-1700, b=800-1000



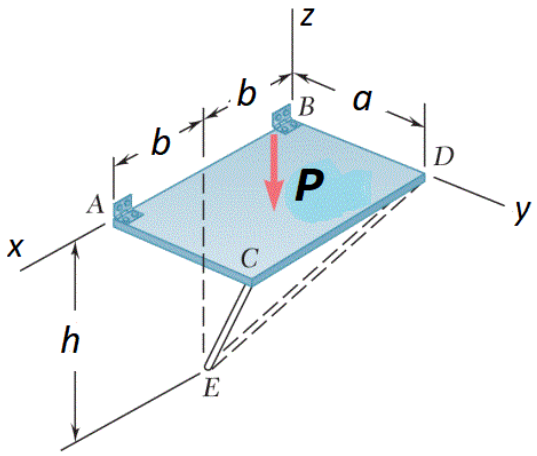
[b] The bent rod ABEF is supported by bearing at C and D, and by wire AH. A vertical force ***F*** of {F} N is applied at end F. Knowing that portion AB of the rod is {d} mm long, determine the tension in wire AH, and reactions at C and D. Given that *a* is {a} mm, *b* is {b} mm, *c* is {c} mm and *d* is {d} mm. Assume that the bearing at D does not exert any axial trust.

F=500-700, a=250-350, b=35-50, c=40-60, d=230-280



[c] The horizontal platform ABCD mass {m} kg and supports a load *P* of {P} N at its center. The platform is normally held in position by hinges at A and B, and by braces CE and DE. If the brace DE is removed, determine the reactions at the hinges and the force exerted by the remaining brace CE. Assume that the hinge at A does not exert any axial trust. Given that *a* is {a} m, *b* is {b} m and *h* is {h} m.

m=15-25, P=400-600, a=3-3.5, b=2-2.5, h=4-5



(100 marks)

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3. [a] (i) Figure 3 [a] shows a lorry on a incline road. The coefficient of static friction between the tires of the 8000-kg lorry and the road is μ_s =0.6. Draw the free body diagram.

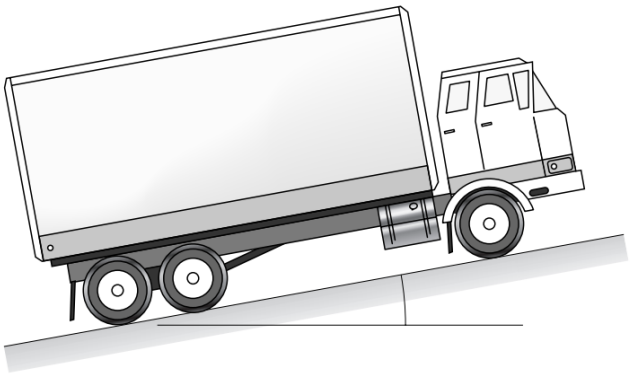

Figure 3 [a]

(ii) If the lorry is stationary on the incline road and α = 15˚, determine the magnitude of the total friction force exerted on the tires by the road.

(iii) Determine the largest value of α for which the truck will not slip?

(50 marks)

[b] (i) Shims are small wedges that can be used to hold an object in place as shown in Figure [b]. The coefficient of kinetic friction between the contacting surfaces is 0.4. Draw the free body diagram.

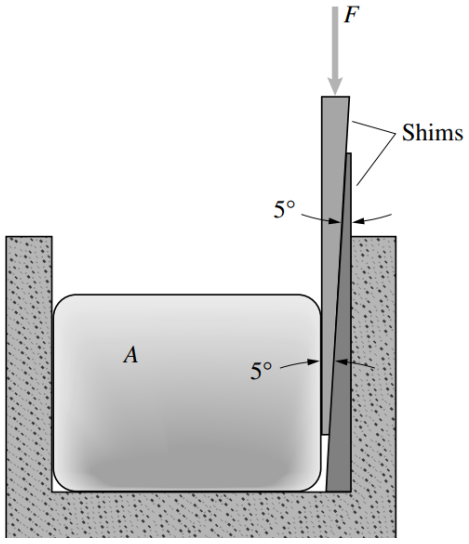

Figure 3 [b]

(ii) Determine the force, F required to push the shim until the horizontal force exerted on block A is 200 N

(50 marks)

...6/-

4. [a] The truss which is used to support a platform at a building is subjected to the indicated loadings as shown in Figure 4. Set P_1 to 3 kN and P_2 to 2 kN. Draw all the forces acting at joint A, B and D.

[b] Determine the force in each member at joint A, B and D, and indicate whether the members are in tension or compression.

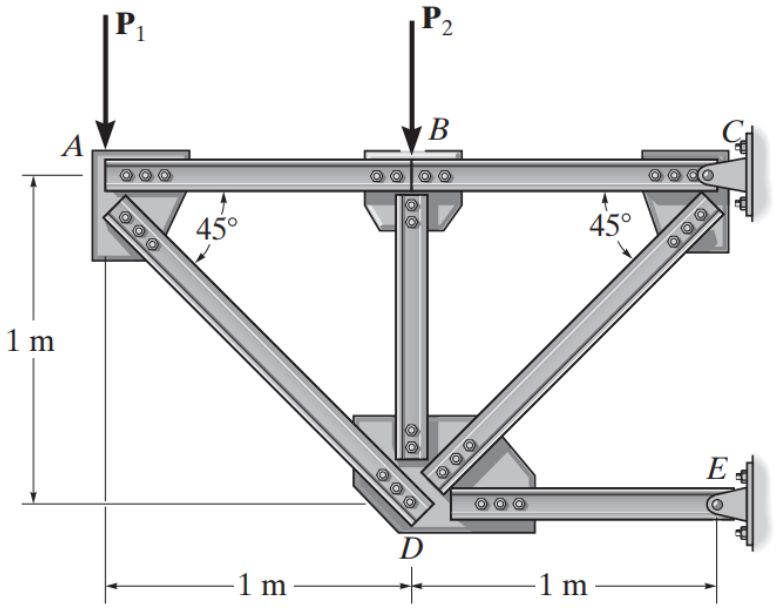

Figure 4 [b]

(100 marks)

5. A thin cylindrical shell with an opening is shown in **Figure 5**. Calculate the *x*-, *y*, and *z*- coordinates of the center of mass of the homogeneous body

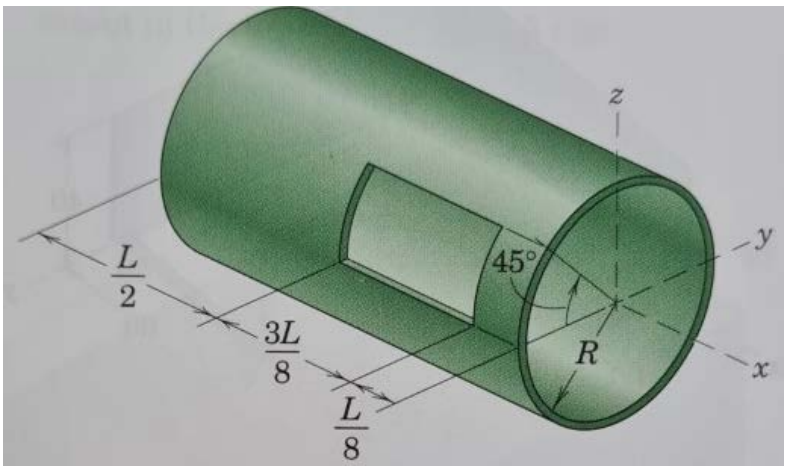

Figure 5

(100 marks)

...7/-

6. Determine the moment of inertia about the *x*- and *y*- axes of the trapezoidal area shown in **Figure 6**.

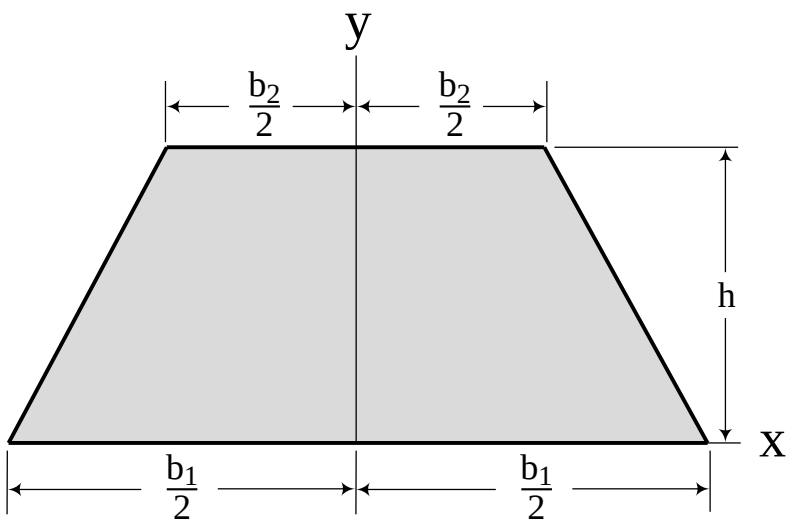

Figure 6

(100 marks)

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