Second Semester Examination
2023/2024 Academic Session

July / August 2024

EMM 102 – Statics
(Statik)

Duration: 3 hours
(Masa: 3 Jam)

Please check that this examination paper consists of SIX (6) pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi ENAM (6) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

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

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

...2/-

1. Given that the magnitude of couple moment ***M*** applied at ***C*** is 1600 Nm and θ is 50°. The couple moment ***M*** lies on *x-y* plane, as shown in Figure 1. Replace the force couple system by an equivalent resultant force and moment at point ***A***.

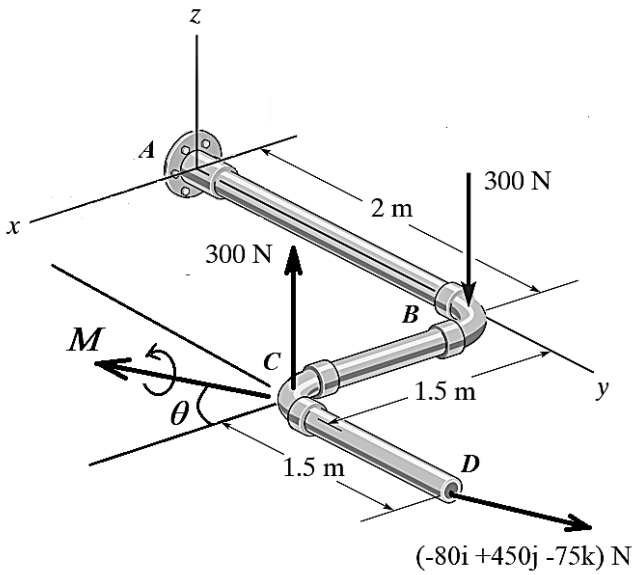

Figure 1

(100 marks)

2. The ***AB*** bar is supported by a ball-and-socket at ***A*** and the two smooth walls at ***B***, as shown in Figure 2. The length of ***AB*** bar is 1.1 m and the tension in the vertical cable ***CD*** is 1.3 kN. Determine the reactions at ***A*** and ***B***.

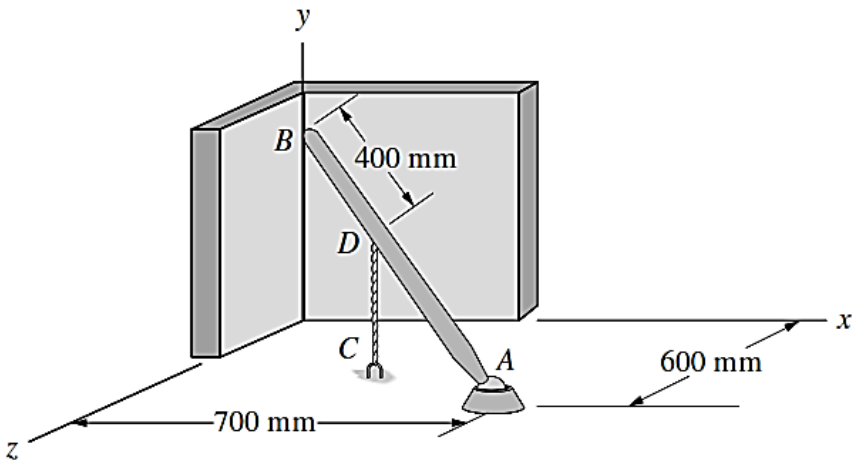

Figure 2

(100 marks)

...3/-

3. (a) A 475 kg steel beam is mounted to the vertical column using a welded pin at ***A*** as shown in Figure 3 (a). The center of gravity of the steel beam is at ***G***. To test the weld strength of the pin at ***A***, the 85 kg man loads the beam by exerting a 450 N force on the rope which passes through a hole in the beam as shown in the figure. Calculate the reaction force and moment developed at pin ***A***.

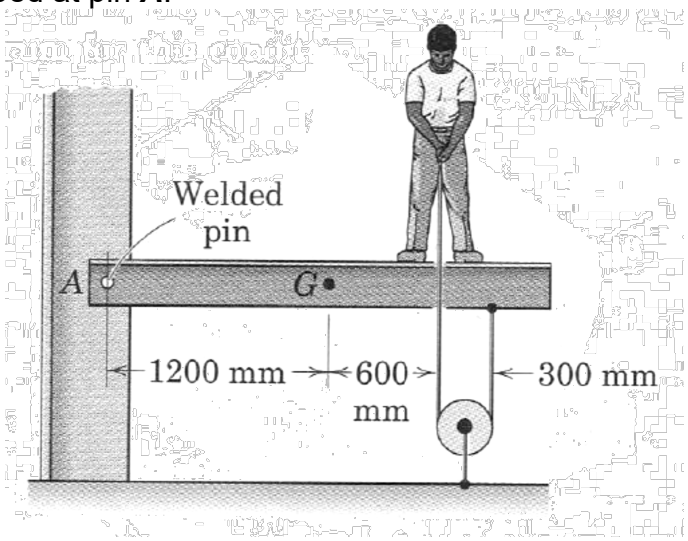

Figure 3 (a)

(50 marks)

(b) The mine car and its contents have a total mass of 6 Mg and a center of gravity at G, as shown in Figure 3 (b). The coefficient of static friction between the wheels and the tracks is $\mu_s = 0.4$ when both wheels A and B are locked. Determine whether the car will move when the horizontal force 30 kN is applied.

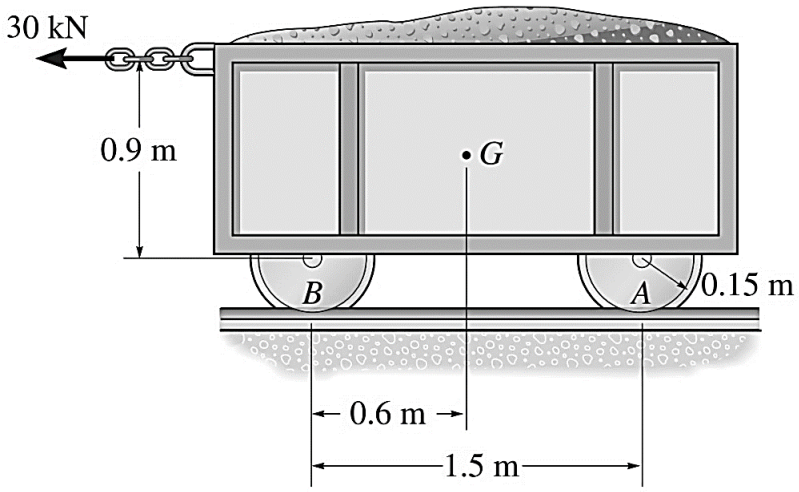

Figure 3 (b)

(50 marks)

...4/-

4. (a) Figure 4 (a) shows a truss with $\mathbf{P}_1$ = 20 kN and $\mathbf{P}_2$ = 10 kN are applied at *C* and *D*, respectively. Determine the force in each member of the truss and state if the members are in tension or compression.

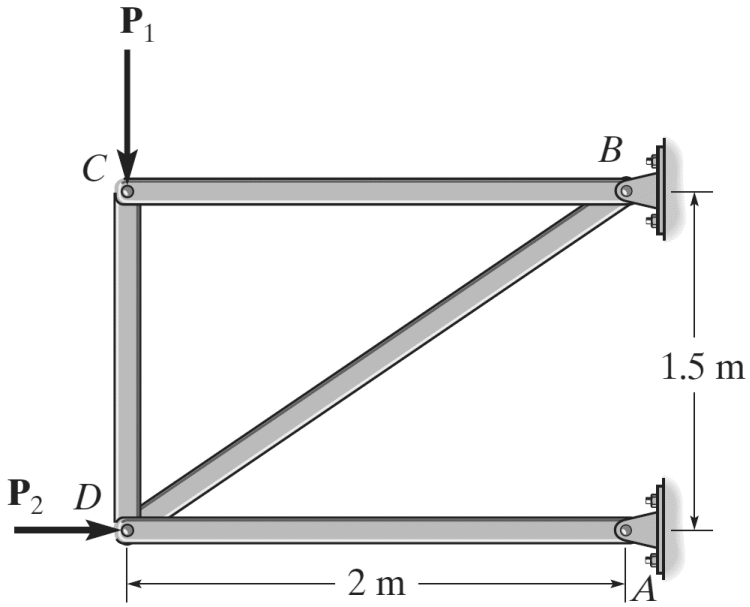

Figure 4 (a)

(40 marks)

(b) Figure 4 (b) shows a toggle clamp used to clamp a smooth wooden block. If a force **P** = 100 N is applied to the handle of the toggle clamp, determine the horizontal clamping force N_E that the clamp exerts on the smooth wooden block at *E*.

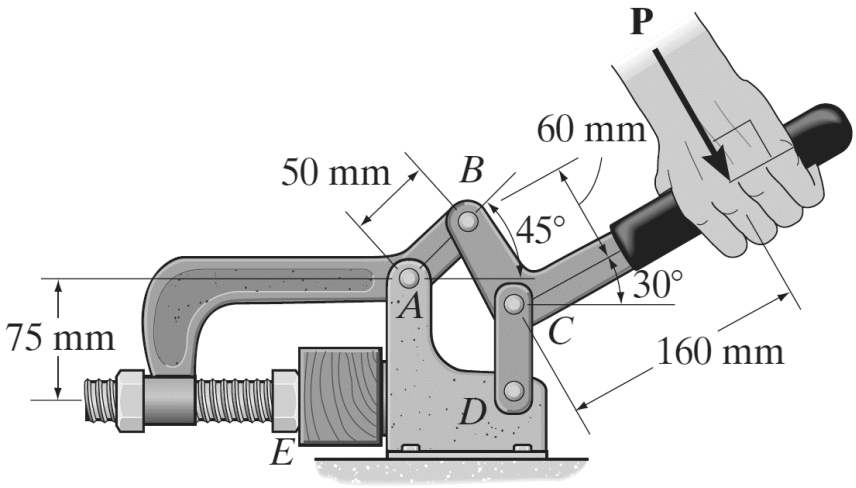

Figure 4 (b)

(60 marks)

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5. (a) Figure 5 (a) shows a picture board and its triangular supporting bracket form a composite surface. Calculate the height h of the support that minimizes the centroidal z-coordinate of the assembly.

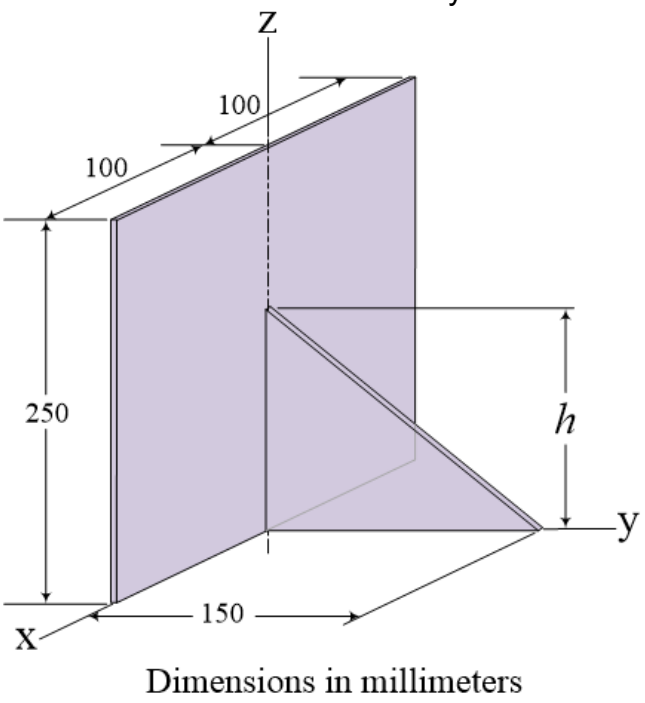

Figure 5 (a)

(50 marks)

(b) Determine the moment of inertia of the shaded area in Figure 5 (b) with respect to the y-axis.

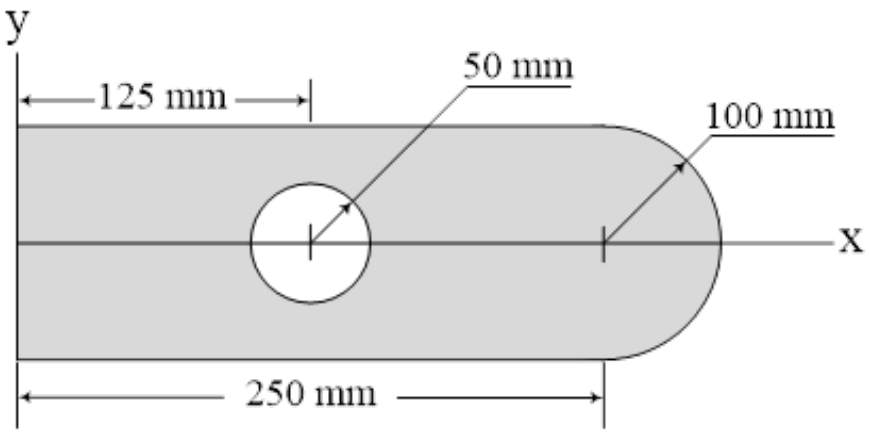

Figure 5 (b)

(50 marks)

...6/-

6. (a) The aluminum block shown in Figure 6 (a) is subjected to an axial compressive force of 40 kN. If the 37.5 mm side changed its length to 37.5033 mm, determine Poisson's ratio and the new length of the 50 mm side. Given that the Young's Modulus of aluminum is E = 70 GPa.

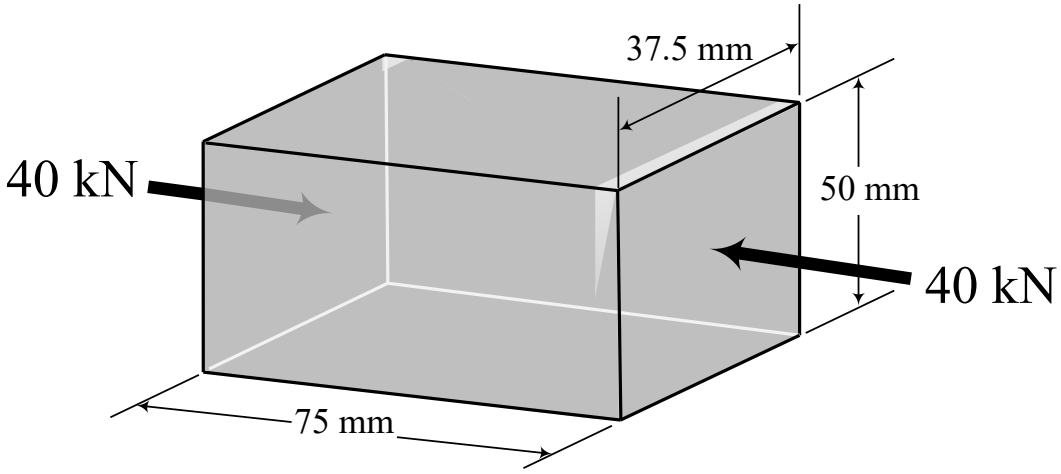

Figure 6 (a)

(40 marks)

(b) The rigid pipe ABC is supported by a pin at A and an A-36 guy wire BD as shown in Figure 6 (b). If the wire has a diameter of 6 mm, determine the load **W** if point B is displaced 1.875 mm downward. Given that the Young's Modulus of wire BD is E = 200 GPa.

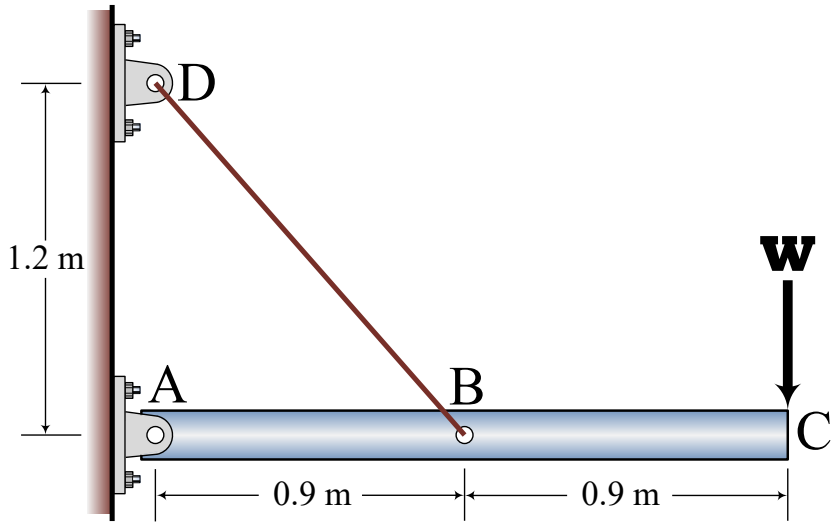

Figure 6 (b)

(60 marks)

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