

CONCORDIA UNIVERSITY

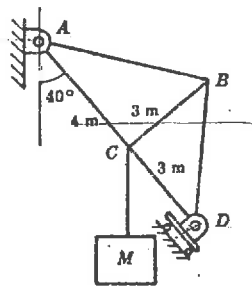
Faculty of Engineering and Computer Science
ENGR 242/4 Statics, Section J
Test #3

Attempt all questions, only calculators permitted

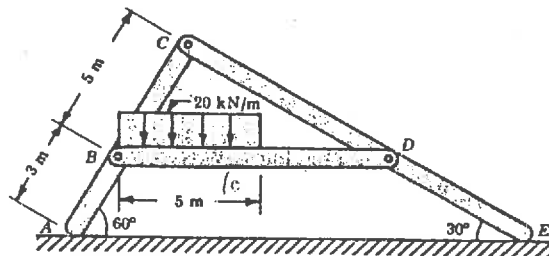
TIME: 70 minutes

MARKS

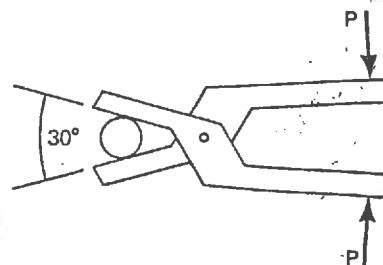
- 35 1) The truss which is pin supported at A and roller supported at D is inclined 40° with the vertical as shown. The members AC and CD are cables which are designed for a maximum tension load of 2000 N. What is the maximum value which the mass M may have?



- 35 2) In the structure shown determine the magnitude of the pin reaction at B on the horizontal member BD. The smooth surface on which the structure rests is horizontal.



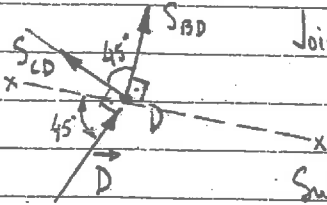
- 30 3) A pair of tongs is used to hold a small steel cylinder as shown. Determine the coefficient of friction that is necessary for the cylinder not to slip. Neglect the weight of the cylinder.



ENGR 242/A - I Test #3 Solutions

1) Entire truss: $(\sum M)_A = 0 = Mg \cdot 4 \sin 40^\circ - D \cdot 7$ (1)

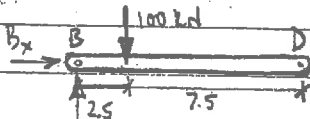
Joint C: Equilibrium in AD direction: $Mg \cos 40^\circ + S_{CD} = 2000$ (2)



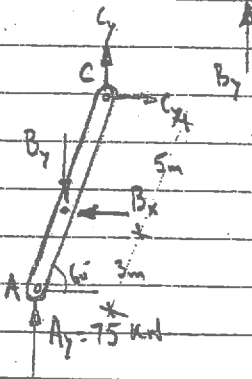
Joint D: $\sum F_{xx} = 0 = S_{CD} \cos 45^\circ - D \cos 45^\circ \Rightarrow S_{CD} = D$ and by substitution into (2): $Mg \cos 40^\circ + D = 2000$ or $D = 2000 - Mg \cos 40^\circ$

Substituting into (1): $Mg \cdot 4 \sin 40^\circ = 7 \cdot (2000 - Mg \cos 40^\circ)$
 $Mg (4 \sin 40^\circ + 7 \cos 40^\circ) = 14000 \Rightarrow \underline{M = 180 \text{ kg}}$

2) Entire frame: $(\sum M)_E = 0 = A_y \cdot 16 - 100 \cdot (16 - 3 \cos 60^\circ - 2.5) = 0 \Rightarrow A_y = 75 \text{ kN}$



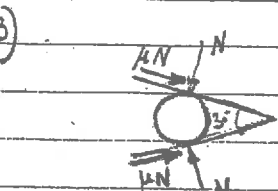
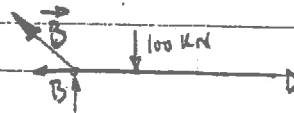
Member BD: $(\sum M)_D = 0 = B_y \cdot 10 - 100 \cdot 7.5 \Rightarrow \underline{B_y = 75 \text{ kN}}$



Member ABC: $(\sum M)_C = 0 = 75 \cdot 8 \cos 60^\circ - 75 \cdot 5 \cos 60^\circ + B_x \cdot 5 \sin 60^\circ$

$\therefore B_x = -112.5 / 5 \sin 60^\circ = \underline{-26 \text{ kN}}$

$\therefore \underline{|B| = \sqrt{75^2 + 26^2} = 79.4 \text{ kN}}$



$\sum F_x = 0 = 2 \mu N \cos 15^\circ - 2N \sin 15^\circ = 0 \Rightarrow \underline{\underline{\mu = \tan 15^\circ = 0.268}}$

REMEMBER TO LEARN FROM YOUR MISTAKES !!!