

ENGG 202 W2012 Midterm 1 Answers

Version 1

Q1 $x = 4 \text{ m}$

max M	$\theta = 63.43 \text{ degrees}$
min M	$\theta = 153.4 \text{ degrees}$

Q2

$\Sigma F_x = 0 =$	$-0.8 T_C +$	$-0.596 T_D +$	$0.8 F_{AB}$	
$\Sigma F_y = 0 =$	$0 T_C +$	$0.298 T_D +$	$0.6 F_{AB}$	$- 1962$
$\Sigma F_z = 0 =$	$-0.6 T_C +$	$0.745 T_D +$	$0 F_{AB}$	

Q3

FBD of B:	Normal force to the left at right surface, gravity force, normal force 45 deg from vertical at left surface (up to the right).
FBD of A:	normal force 20 from vertical at lower sloped surface (up to the right), normal force 45 deg from vertical at upper sloped surface (down to the left), gravity force, F to the right

Q4

$T_1 = 331.4 \text{ N}$
$T_2 = 52.7 \text{ N}$

Q5 $F = 15 \text{ kN}$ $M = 18 \text{ kNm}$

$L_{\max} = 2.4 \text{ m}$

Q6 $x = 700 \text{ mm}$
 $z = 600 \text{ mm}$

$\theta = 44.76 \text{ degrees}$

Q7 $F = 30 \text{ N}$
 $W = 40 \text{ N}$
 $h = 50 \text{ mm}$

$N_A = 40.25 \text{ N}$	at	41.81 degrees	\angle
$N_B = 13.17 \text{ N}$	up		

Q8 $x_C = 200 \text{ mm}$ $x_B = 0 \text{ mm}$
 $y_C = 55 \text{ mm}$ $y_B = 180 \text{ mm}$
 $z_C = 390 \text{ mm}$ $z_B = 360 \text{ mm}$
 $m = 4 \text{ kg}$

$U_{AB} \cdot (r_{AG} \times W) = -3871.03 \text{ Nmm}$

$U_{AB} \cdot (r_{AD} \times T) = 177.93 \text{ T}$

$T = 21.7559 \text{ N}$

$T_{CD} = (-3.95 \text{ i} + 17.56 \text{ j} + 12.23 \text{ k}) \text{ N}$
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