FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Foundation in Science (CFSI)
Course	:	**EGR1203: Engineering Mechanics**
Date of Examination	:	7 August 2020 (Friday)
Time	:	9:00am – 11:30am Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL FOUR (4)** questions.
All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner(s)	:	**Ms. Nur Hafizah Binti Habideen**
Chief Moderator	:	Dr. Beh Boon Chun

This paper consists of 7 printed pages, including the cover page.

FOUNDATION IN SCIENCE PROGRAMME (CFSI)
EGR1203: ENGINEERING MECHANICS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer all **FOUR (4)** questions. All questions carry equal marks.

Question 1

(a) The plate is subjected to the two forces at *A* and *B* as shown in Figure Q1a. If θ = 60º, determine the magnitude of the resultant of these two forces and its direction measured clockwise from the horizontal.

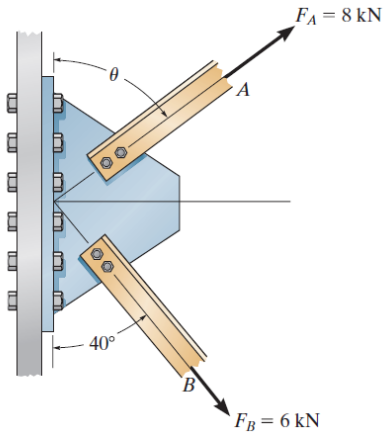

Figure Q1a

(8 marks)

(b) Express each of three forces acting on the support in Cartesian vector form and determine the magnitude of the resultant force and its direction, measured clockwise from positive *x* axis.

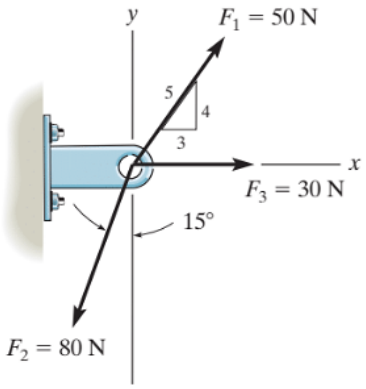

Figure Q1b

(8 marks)

(c) The lift sling is used to hoist a container having a mass of 500 kg. Determine the force in each of the cables *AB* and *AC* as a function of θ. If the maximum tension allowed in each cable is 5 kN, determine the shortest length of cables *AB* and *AC* that can be used for the lift. The centre of gravity of the container is located at *G*.

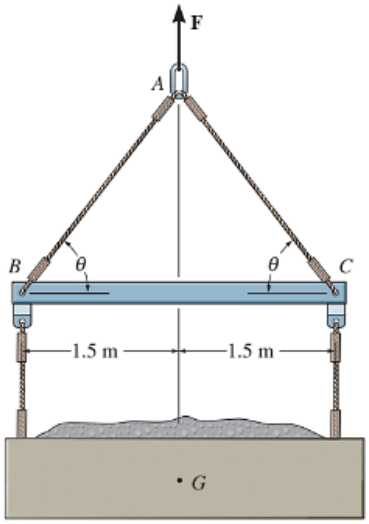

Figure Q1c

(9 marks)

Question 2

(a) Determine the force in each member of the truss. State whether the members are in tension or compression. Set P = 8 kN.

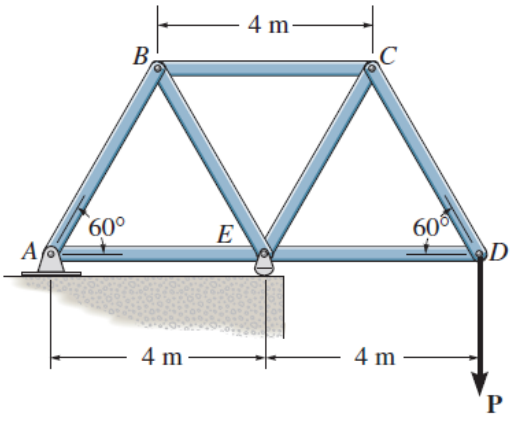

Figure Q2a

(12 marks)

(b) Determine the internal normal force, shear force and the moment at points C and D.

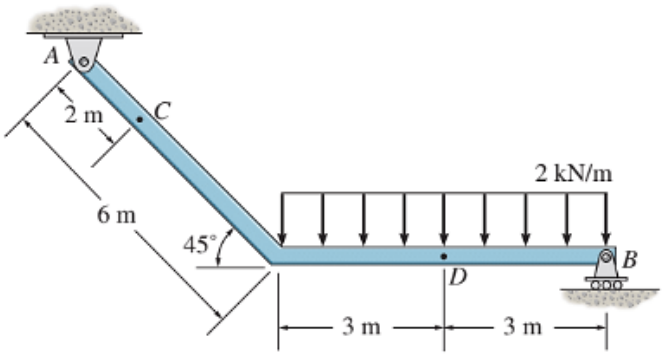

Figure Q2b

(13 marks)

Question 3

(a) Determine the required magnitude of force ***F***, if the resultant couple moment on the beam is to be zero.

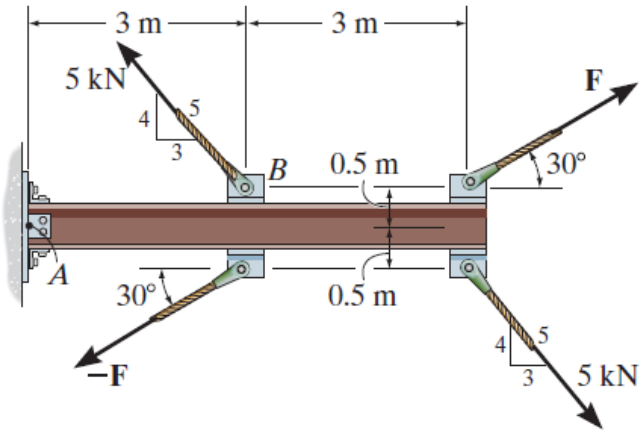

Figure Q3a

(6 marks)

(b) Determine the moment of force F about point O. The force has a magnitude of 800 N and coordinate direction angles of $\alpha = 60^o$, $\beta = 120^o$, $\gamma = 45^o$. Express the result as a Cartesian vector.

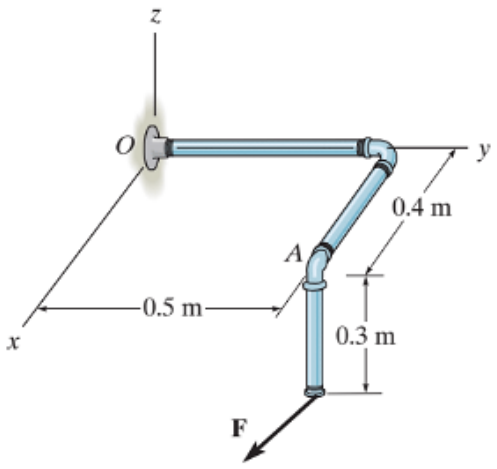

Figure Q3b

(6 marks)

(c) Determine the reactions at the pin A and the tension in cord BC. Set F = 40 kN. Neglect the thickness of the beam.

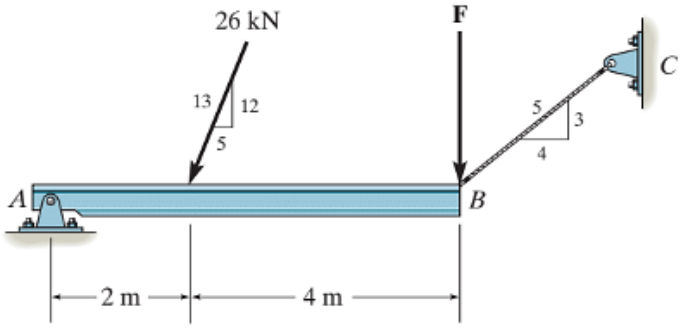

Figure Q3c

(6 marks)

(d) The mine car and its contents have a total mass of 6000 kg and a center of gravity at G. If the coefficient of static friction between the wheels and the tracks is $\mu_s = 0.4$ when the wheels are locked, find the normal force acting on the front wheels at B and the rear wheels at A when the brakes at both A and B are locked. Does the car move?

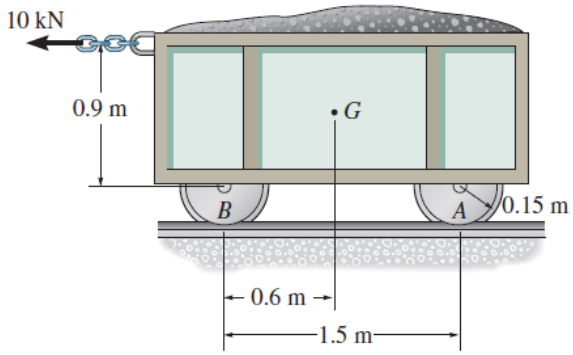

Figure Q3d

(7 marks)

Question 4

(a) The uniform 10 kg ladder rests against the smooth wall at *B*, and the end *A* rests on the rough horizontal plane for which the coefficient of static friction is $\mu_s = 0.3$. Determine the angle of inclination θ of the ladder and the normal reaction at *B* if the ladder is on the verge of slipping.

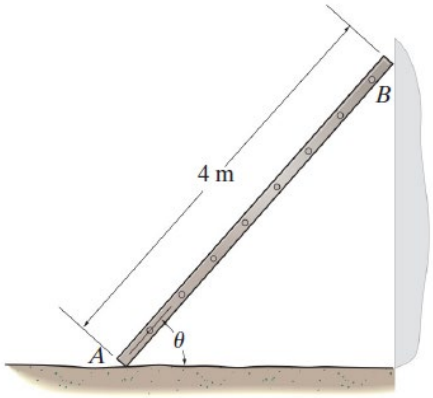

Figure Q4a

(7 marks)

(b) The steel and aluminum plate assembly are bolted together and fastened to the wall. Each plate has a constant width in the z direction of 200 mm and thickness of 20 mm. If the density of A and B is $\rho_s = 7.85\ Mg/m^3$ and for C is, $\rho_{al} = 2.71\ Mg/m^3$,determine the location of the center of mass. Neglect the size of the bolts.

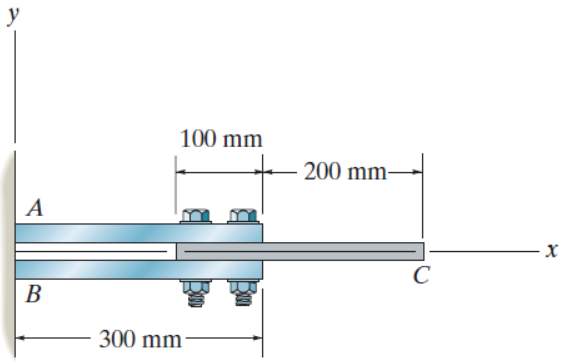

Figure Q4b

(6 marks)

(c) Determine $\bar{y}$, which locates the centroidal axis x' for the cross-sectional area of the T-beam, and then find the moments of inertia Ix'.

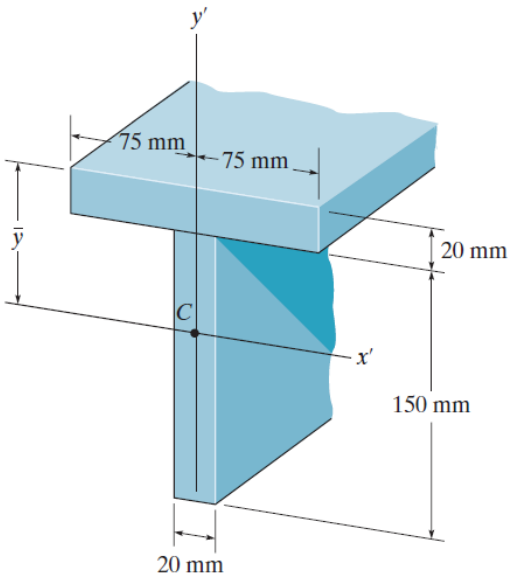

Figure Q4c

(12 marks)

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