**FINAL**
Alternative Assessment

(COVER PAGE)

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| Session | : | **August 2020** |
| Programme | : | Foundation in Science (CFSI) |
| Course | : | **EGR1203: Engineering Mechanics** |
| Date of Examination | : | 17 December 2020 (Thursday) |
| 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) | : | **Dr. Beh Boon Chun** |
| Chief Moderator | : | Dr. Aaron Edward Teo |

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

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

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

**Question 1**

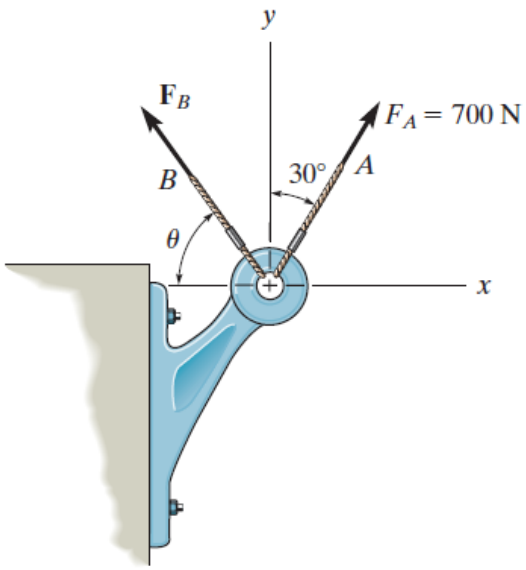


**Figure Q1a-b**

**(a)** Referring to **Figure Q1a-b**, find the magnitude and orientation $\theta$ of $F_B$ so that the resultant force is heading upwards of the $y$ axis and has a magnitude of 1.5 kN.
(6 marks)

**(b)** Referring to **Figure Q1a-b**, find the magnitude and orientation, measured anti-clockwise from the positive y axis, of the resultant force acting on the support, if $F_B$ = 0.6 kN and $\theta = 20^\circ$.
(7 marks)

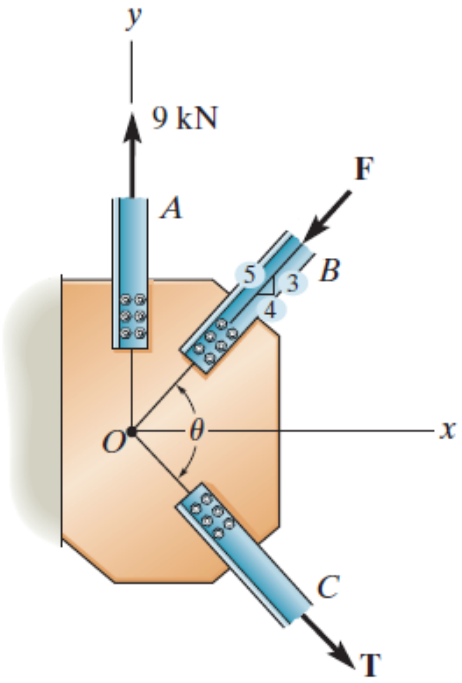


**Figure Q1c-d**

**(c)** Referring to **Figure Q1c-d**, a support plate connects the various members of a truss. If the forces all intersect at point O, determine the magnitudes of $F$ and $T$ so that the resultant force is zero. Use $\theta = 90^\circ$.

(6 marks)

**(d)** Referring to **Figure Q1c-d**, the forces of the three members are acted on the plate. Calculate the force in member C (tension) and its angle $\theta$ so that the resultant force is zero. The forces all intersect at point O. Use $F = 8000$ N.

(6 marks)

**Question 2**

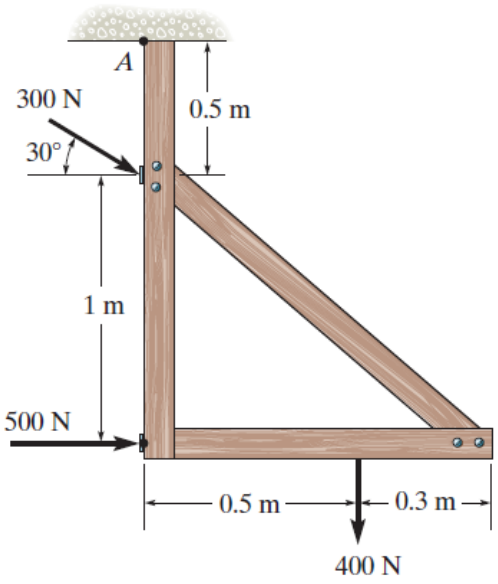


**Figure Q2a**

**(a)** Referring to **Figure Q2a**, substitute all the loadings acting on the frame with an equivalent resultant force and couple moment acting at a point A.

(12 marks)

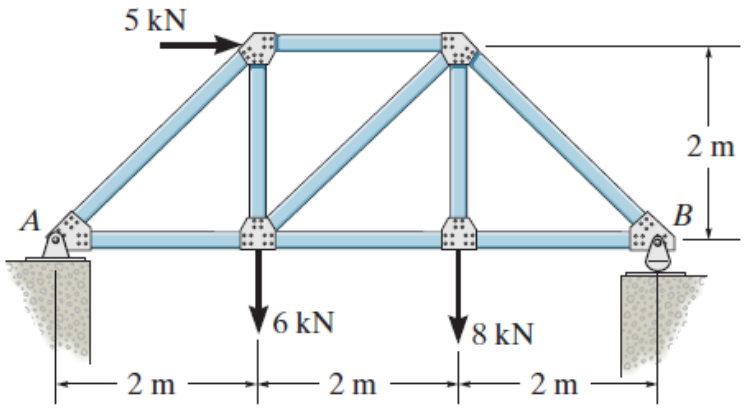


**Figure Q2b**

**(b)** Referring to **Figure Q2b**, calculate the reactions at the supports.

(6 marks)

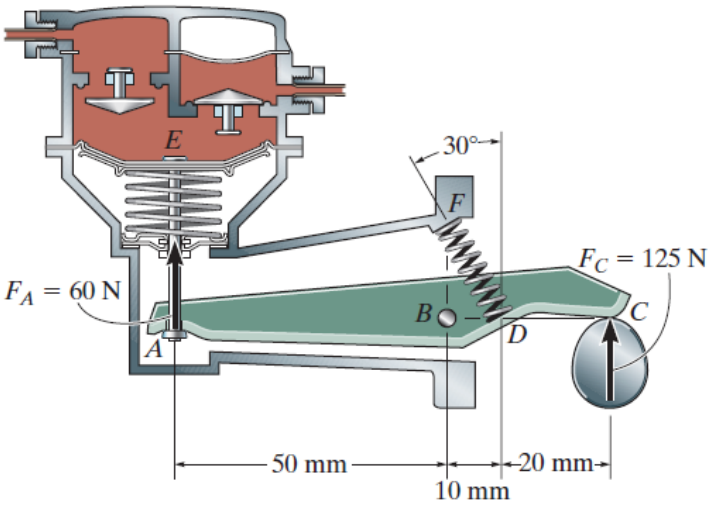


**Figure Q2c**

**(c)** Referring to **Figure Q2c**, for an oil pump in a car to work, it relies on the reciprocating action of the rocker arm ABC, which is pinned at B and loaded with spring at A and D. When the frictionless cam C is in the position shown, find the horizontal and vertical components of force at the pin and the force along the spring DF for equilibrium. The vertical force acting on the rocker arm at A is $F_A$ = 60 N, and at C it is $F_C$ = 125 N.

(7 marks)

**Question 3**

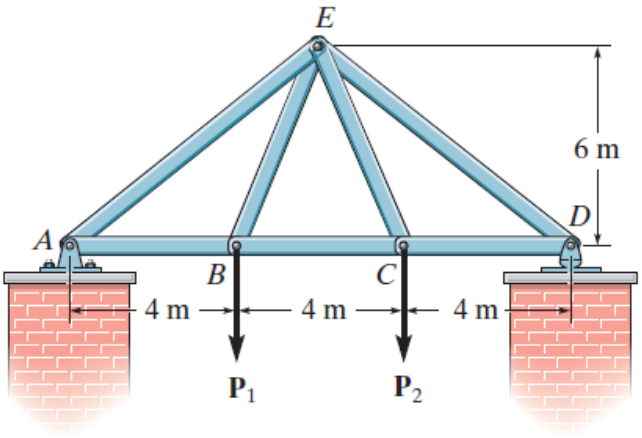


**Figure Q3a**

**(a)** Referring to **Figure Q3a**, find the force in member AE, AB, DE and DC of the truss and state if the members are in tension or compression. Set $P_1$ = 6000 N, $P_2$ = 9000 N.

(13 marks)

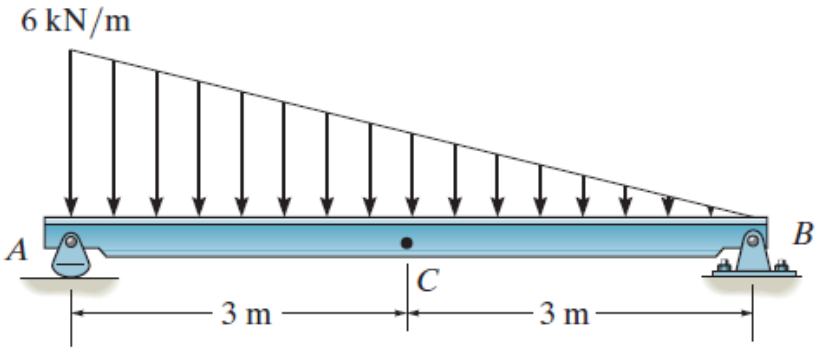


**Figure Q3b**

**(b)** Referring to **Figure Q3b**, determine the internal normal force, shear force, and moment at point C.

(12 marks)

**Question 4**

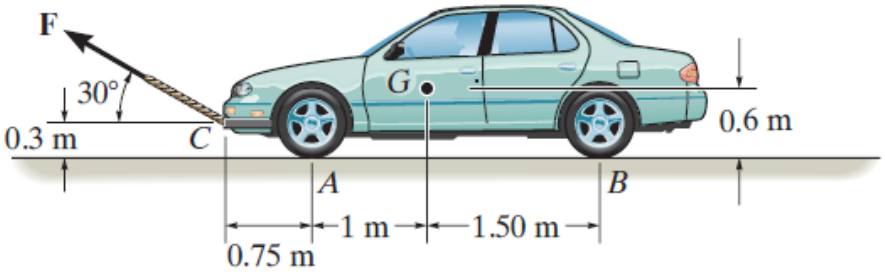


**Figure Q4a**

**(a)** Referring to **Figure Q4a**, the 2000 kg car has a center of mass at G. Calculate the friction force acting on the wheels (A and B) and force *F* required to move the car. Note that the front and rear wheels are locked. Given $\mu_s = 0.3$.

(12 marks)

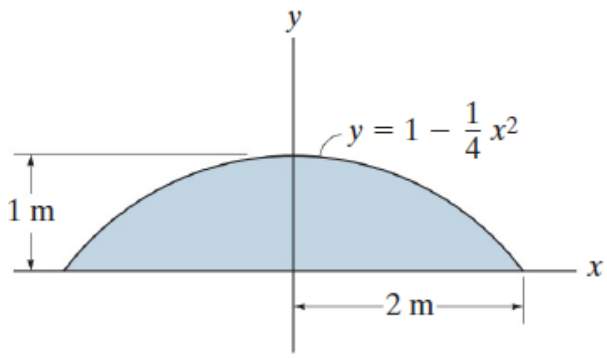


**Figure Q4b**

**(b)** Locate the centroid $\bar{y}$ of the area as shown in **Figure Q4b**.

(8 marks)

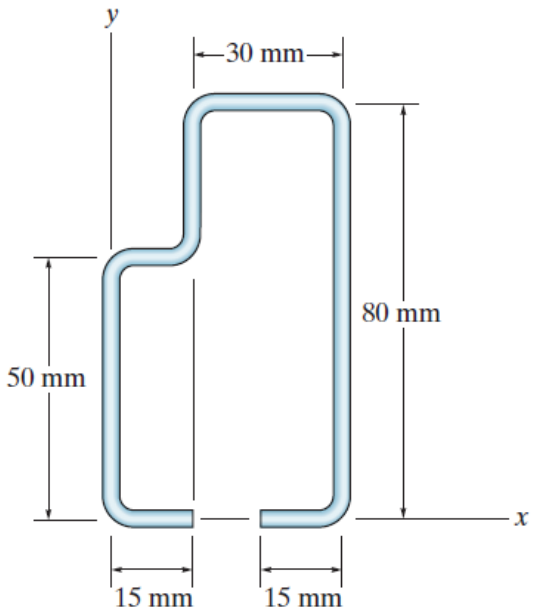


**Figure Q4c**

**(c)** A steel shelf is made using roll forming and has the cross section as shown in **Figure Q4c**. Find the location $(\bar{x}, \bar{y})$ of the centroid of the cross section. The dimensions shown are taken at the center of the thickness of each segment.

(5 marks)

**~ The End ~**