FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2021**
Programme	:	Foundation in Science (CFSI)
Course	:	**EGR1203: Engineering Mechanics**
Date of Examination	:	30 July 2021 (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** questions.

All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner(s)	:	**Mr. Dinash Kandasamy**
Chief Moderator	:	Ms. Nurhakimah Abd Aziz

*This paper consists of **6** printed pages, including the cover page.*

FOUNDATION IN SCIENCE (CFSI)
EGR1203: ENGINEERING MECHANICS
FINAL ALTERNATIVE ASSESSMENT: APRIL 2021 SESSION

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Question 1

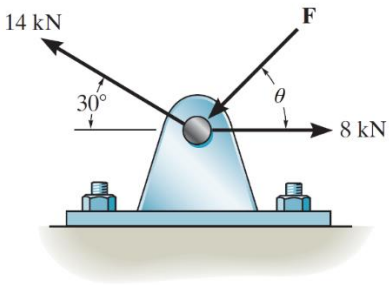

Figure Q1a-b

(a) Referring to **Figure Q1a-b**, determine the magnitude F so that the resultant force is smallest if $\theta = 45°$. Then determine the magnitude and direction of the resultant force counter clockwise from $+x$ axis. (10 marks)

(b) Referring to **Figure Q1a-b**, determine the angle, θ for F from counter clockwise from the +x-axis that produces the smallest possible resultant force, if $F = 3$ kN. Then determine the magnitude and direction of the resultant force. (3 marks)

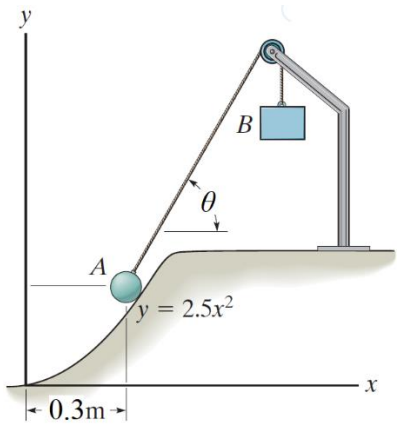

Figure Q1c-d

(c) Referring to **Figure Q1c-d**, a 6 kg sphere rests on the smooth parabolic surface and angle, $\theta = 40°$. Find the mass m_B of block B required to keep A stationary. Then determine the normal force acting on A. (6 marks)

(d) Referring to **Figure Q1c-d**, the 6 kg sphere is then lowered to $y = 0.1$ m. The angle increases to $\theta = 50°$. Find the mass m_B of block B required to keep A stationary in this new position. Then determine the normal force. (6 marks)

Question 2

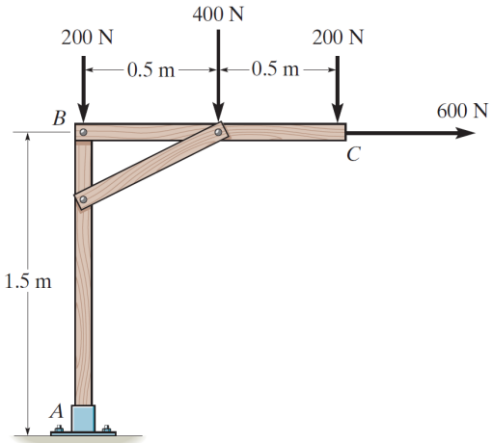

Figure Q2a

(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. (6 marks)

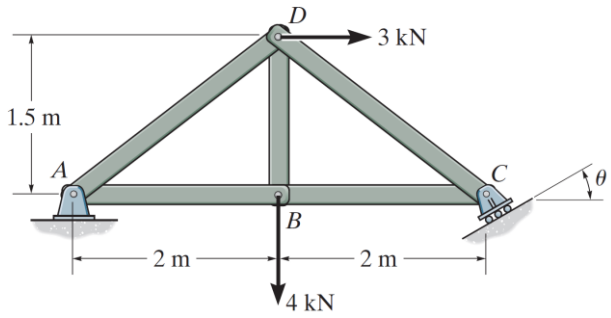

Figure Q2b

(b) Referring to **Figure Q2b**, calculate the reactions at the pinned support at A and roller support at B when $\theta = 45°$. (9 marks)

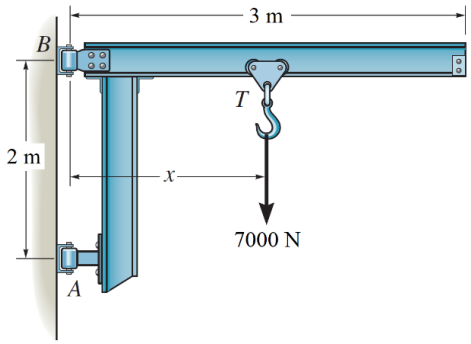

Figure Q2c

(c) Referring to **Figure Q2c**, a cantilevered jib crane supports a load of 7000 N. If the trolley T can travel between $0.9\,\text{m} \leq x \leq 3.0\,\text{m}$, determine the maximum magnitude of reaction at the supports A and B. Note that the supports allow the crane to rotate freely about the vertical axis. The support B supports a force in the vertical direction, whereas the one at A does not. (10 marks)

Question 3

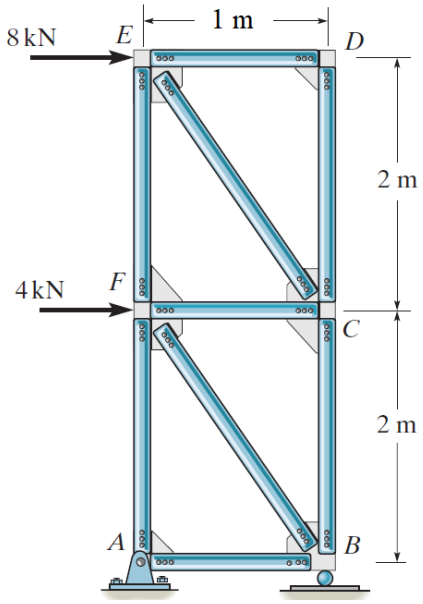

Figure Q3a

(a) Referring to **Figure Q3a**, determine the force in member AF, BF, BC and AB of the truss and state if the members are in tension or compression. (14 marks)

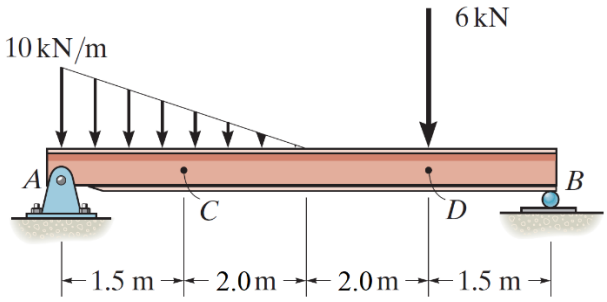

Figure Q3b

(b) Referring to **Figure Q3b**, determine the internal normal force, shear force, and moment at point C. (11 marks)

Question 4

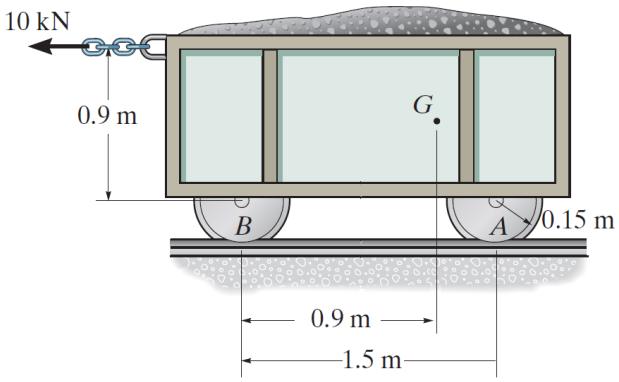

Figure Q4a

(a) Referring to **Figure Q4a**, the 1000 kg mine car has 1500 kg of coal in it. The center of mass of the fully loaded mine car is at G. Calculate the friction force acting on the wheels (A and B). Note that the front and rear wheels are locked. Given coefficient of static friction $\mu_s = 0.35$. (9 marks)

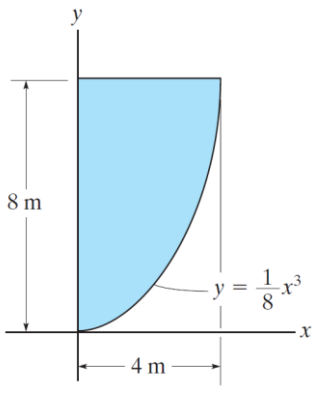

Figure Q4b

(b) Locate the centroid $\bar{y}$ of the area as shown in **Figure Q4b**. (8 marks)

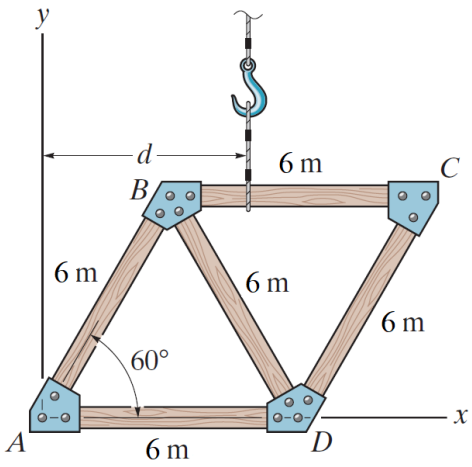

Figure Q4c

(c) A five member truss, with each member having a length of 6 m and a mass of 5 kg/m is suspended by a hoisting cable as shown in **Figure Q4c**. Determine the distance d to where the hoisting cable must be attached, so that the truss does rotate when it is lifted. Assume mass of gusset plates is negligible. (8 marks)

~ The End ~