INTI
International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	APRIL 2018
Programme	:	Foundation In Science (CFSI)
Course	:	**EGR1203: ENGINEERING MECHANICS**
Date of Examination	:	30th July 2018 (Monday)
Time	:	2:00pm – 4:00pm Reading Time : NIL
Duration	:	2 HOURS
Special Instructions	:	

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided.

Materials permitted :

Non-Programmable Scientific Calculator

Materials provided :

Examiner(s)	:	**Dr. Aaron Edward Teo**
Moderator	:	Assoc. Prof. Dr Khoo Bee Ee

*This paper consist of **8** printed pages, including the cover page.*

INTI INTERNATIONAL COLLEGE PENANG

FOUNDATION IN SCIENCE (CFSI)
EGR1203: ENGINEERING MECHANICS
FINAL EXAMINATION: APRIL 2018 SESSION

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Question 1

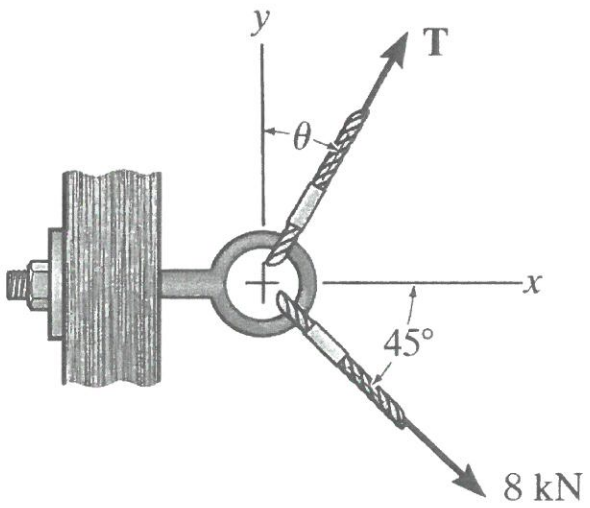

Figure Q1a-b

a) If $\theta = 60°$ and T = 6 kN, determine the magnitude of the resultant force acting on the eyebolt and its direction measures clockwise from the positive x axis. Refer to Figure Q1a-b.

[6 marks]

b) If the magnitude of the resultant force is to be 9 kN directed along the positive x axis, determine the magnitude of force T acting on the eyebolt and its angle θ. Refer to Figure Q1a-b.

[6 marks]

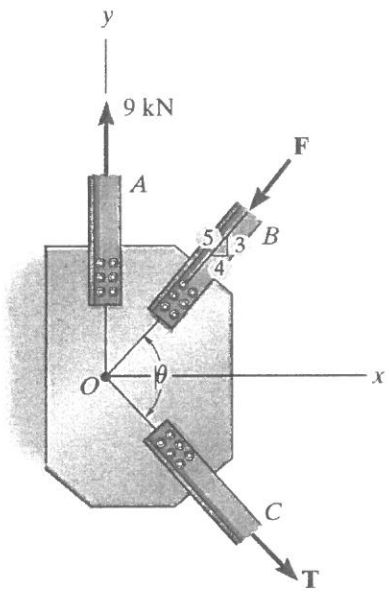

Figure Q1c-d

c) The members of a truss are connected to the gusset plate. If the forces are concurrent at point O, determine the magnitudes of F and T for equilibrium. Take $\theta = 90°$. Refer to Figure Q1c-d.

[6 marks]

d) The gusset plate is subjected to the forces of three members. Determine the tension force, T, in member C and angle θ for equilibrium. The forces are concurrent at point O. Take F = 8 kN. Refer to Figure Q1c-d.

[7 marks]

Question 2

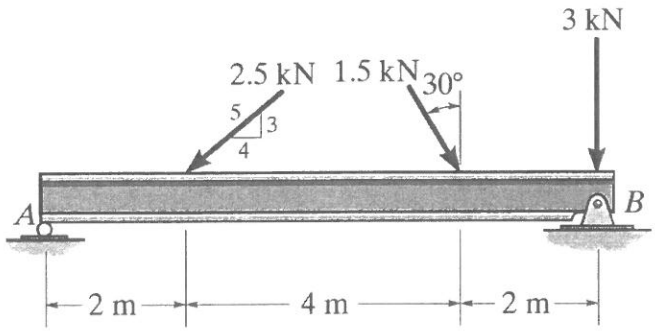

Figure Q2a

a) Replace the force system acting on the beam by an equivalent force and couple moment at point B. Refer to Figure Q2a.

[10 marks]

b) What is a two force member? Briefly explain your answer.

[3 marks]

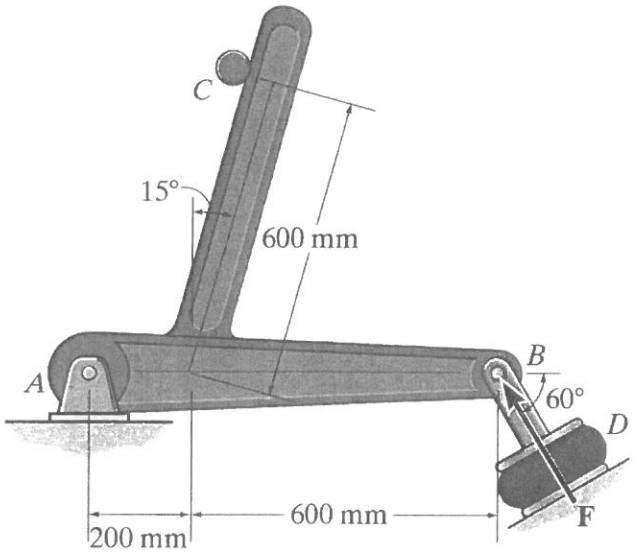

Figure Q2c

c) The actuator at D is used to apply a force of F = 200 N on the member at B. Referring to Figure for Q2c, determine the horizontal and vertical components of reaction at pin A and the force at C on the member. (Hint: Draw the FBD showing all forces to simplify the problem)

[8 marks]

d) Starting from rest, a particle moving in a straight line has an acceleration of a = (2t - 6) m/s^2, where t is in seconds. What is the particle's velocity when t = 6 s, and what is its position when t = 11 s?

[4 marks]

Question 3

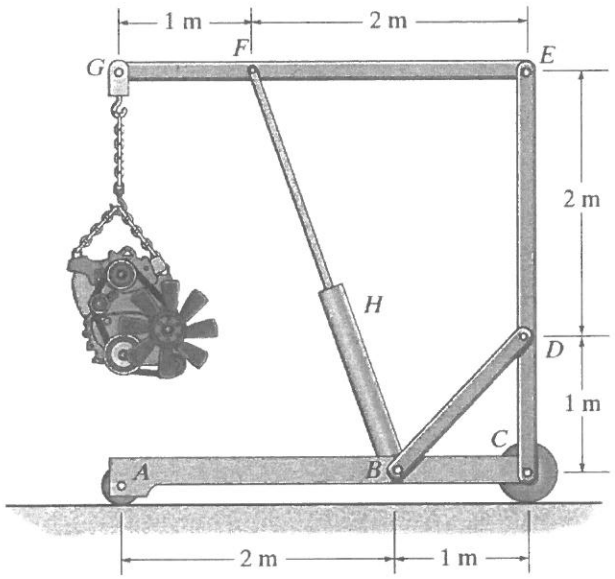

Figure Q3a

a) The hoist supports the 125-kg engine. Determine the force in member DB and in member FB. Refer to Figure Q3a. (Hint: Draw FBD for member GE then proceed to EC)

[12 marks]

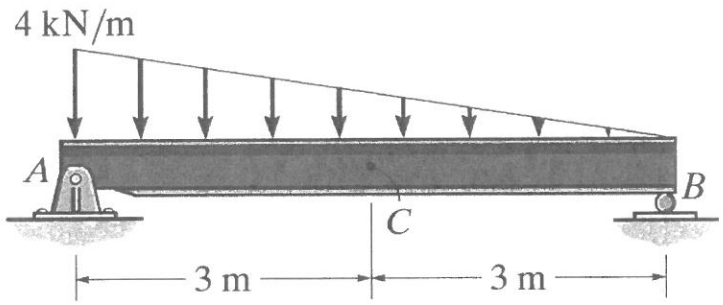

Figure Q3b

b) Determine the internal normal force, shear force, and moment at point C in the simply supported beam as shown in Figure Q3b.

[13 marks]

Question 4

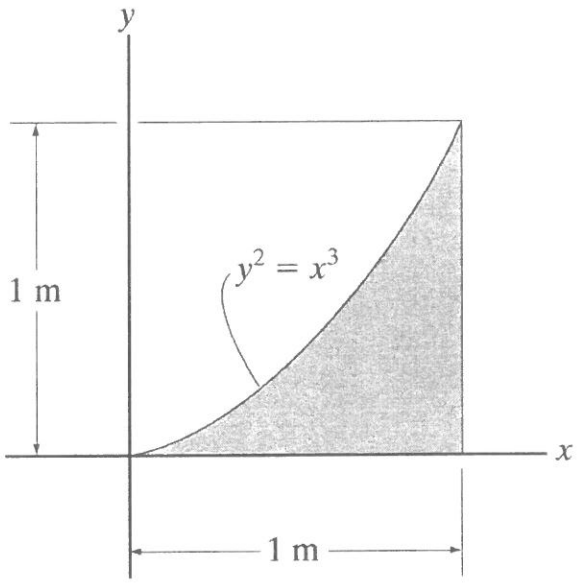

Figure Q4a-b

a) Determine the area and the centroid $(\bar{x}, \bar{y})$ of the shaded area. Refer Figure Q4a-b.
[7 marks]

b) Determine the moment of inertia of the shaded area about the x axis. Refer Figure Q4a-b.
[4 marks]

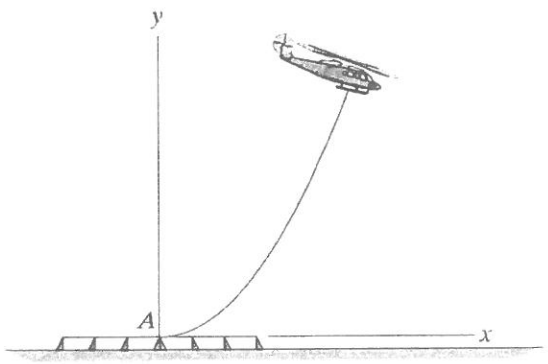

Figure Q4c

c) The flight path of the helicopter as it takes off from A is defined by the parametric equations, $\mathbf{x = (2t^2)}$ m and $\mathbf{y = (0.04t^3)}$ m, where t is the time in seconds. Determine the distance of the helicopter from point A and the magnitudes of its velocity and acceleration when t = 10 s. Refer to Figure Q4c.
[10 marks]

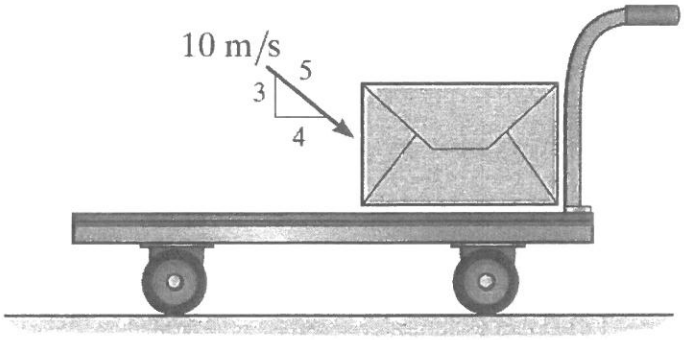

Figure Q4d

d) The cart and package have a mass of 20 kg and 5 kg, respectively. If the cart has a smooth surface and it is initially at rest, while the velocity of the package is as shown, determine the final common velocity of the cart and package after the impact. Refer to Figure Q4d.

[4 marks]

Question 5

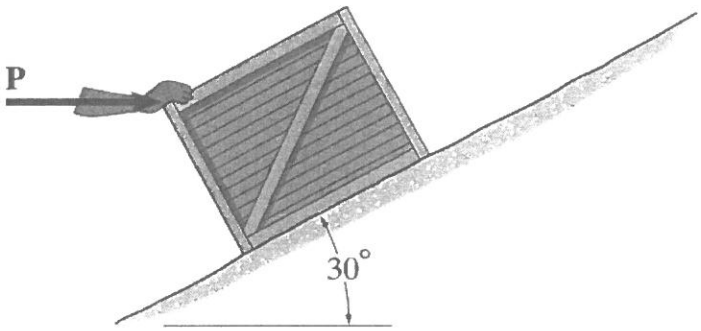

Figure Q5a-b

a) Determine the minimum horizontal force P required to hold the crate from sliding down the plane. The crate has a mass of 50 kg and the coefficient of static friction between the crate and the plane is $\mu_s = 0.25$. Refer to Figure Q5a-b.

[6 marks]

b) Determine the minimum force P required to push the crate up the plane. The crate has a mass of 50 kg and the coefficient of static friction between the crate and the plane is $\mu_s = 0.25$. Refer to Figure Q5a-b.

[6 marks]

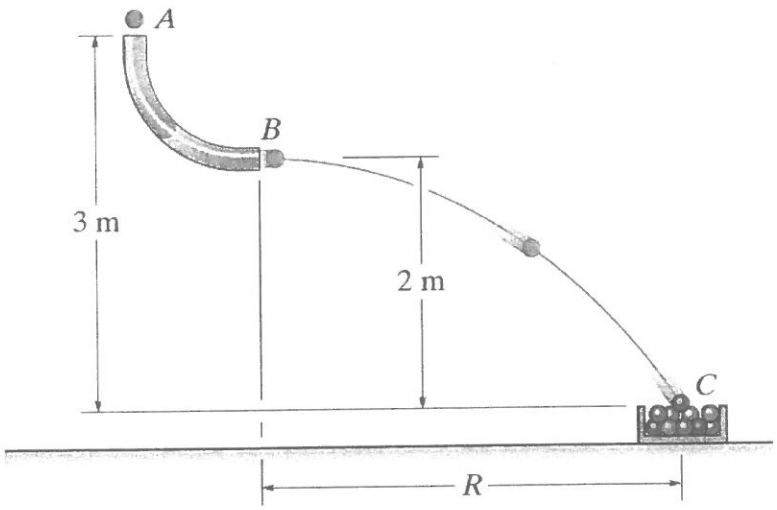

Figure Q5c

c) Marbles having a mass of 5 g are dropped from rest at A through the smooth glass tube and accumulate in the can at C. Referring to Figure Q5c, determine the placement R of the can from the end of the tube and the speed at which the marbles fall into the can. Neglect the size of the can. (Hint: Calculate velocity at B first)

[8 marks]

d) A 2.5-Mg van is traveling with a speed of 100 km/h when the brakes are applied and all four wheels lock (wheels does not turn and car slides). If the speed decreases to 40 km/h in 5 s, determine the coefficient of kinetic friction between the tires and the road.

[5 marks]

~ The End ~

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