INTI INTERNATIONAL UNIVERSITY

FOUNDATION PROGRAMME (ENGINEERING/SCIENCE) (CFSI)

EGR 1203: ENGINEERING MECHANICS
FINAL EXAMINATION: JANUARY 2016 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the paper provided. All questions carry equal marks.

Question 1

(a) Calculate $(0.00453\ Mg)(200\ ms)$ to *three significant figures* and express the answer in SI units using an appropriate *prefix*.

(5 marks)

(b) The bracket is subjected to the two forces as shown as in Figure Q1-(b)

i) Express the vector force $\mathbf{F_1}$ and force $\mathbf{F_2}$ into Cartesian vector format.

(6 marks)

ii) Find the magnitude and coordinate direction angle of the resultant force.

(5 marks)

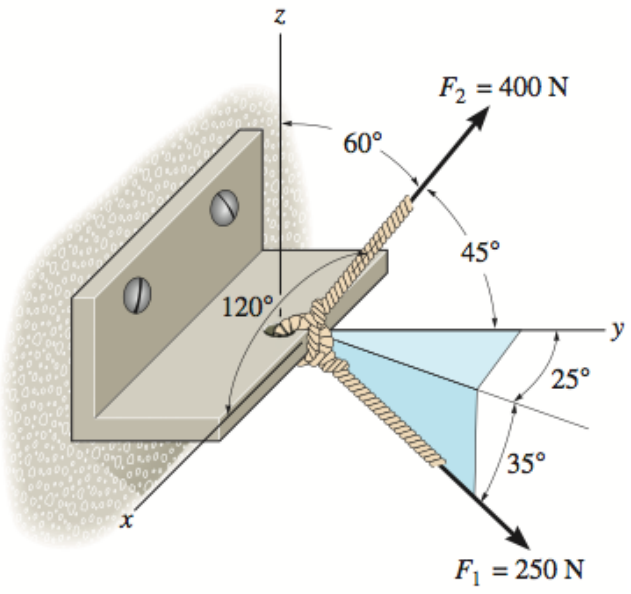


Figure Q1-(b)

(c) The spring DB in Figure Q1-(c) has an un-stretched length of 2m.

i) Determine the force developed in DC and DB.

(6 marks)

ii) Determine the stiffness of the spring to hold the 40 kg crate in equilibrium position.

(3 marks)

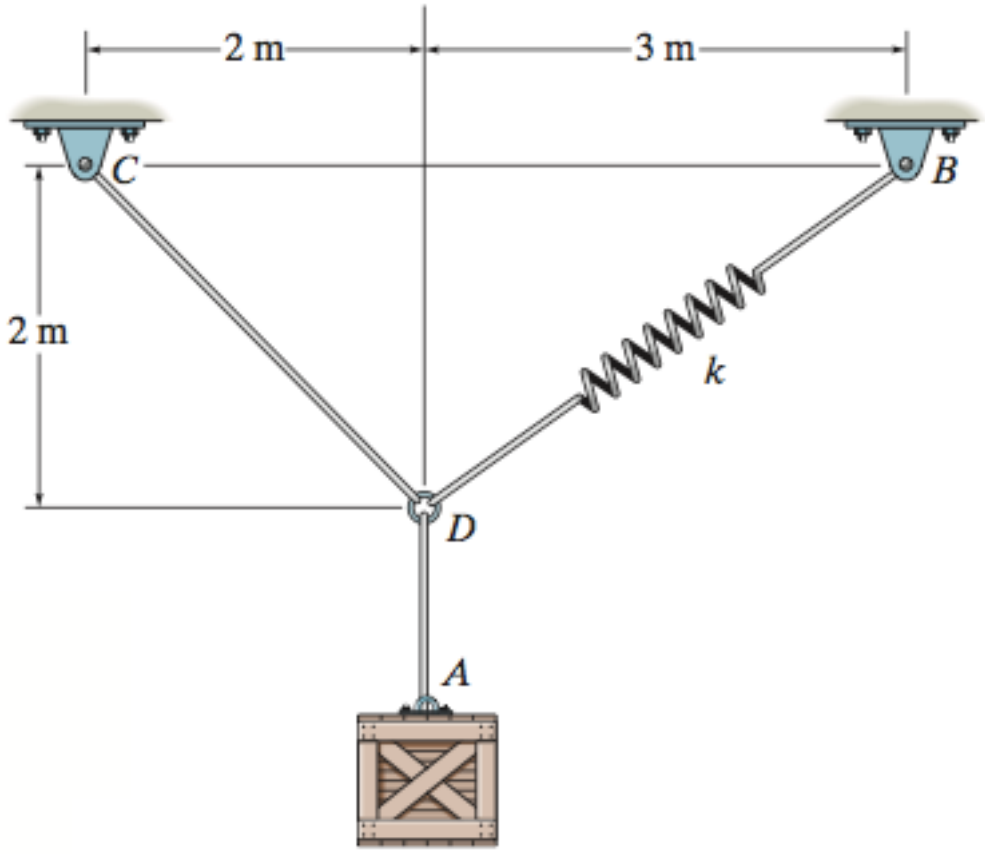


Figure Q1-(c)

Question 2

(a) Following questions are based on Figure Q2-(a). The force **F** causes moment about point *P*.

i) Determine the position vector $\boldsymbol{r}$

(4 marks)

ii) Calculate the moment of the force about point P and express the result in Cartesian vector.

(5 marks)

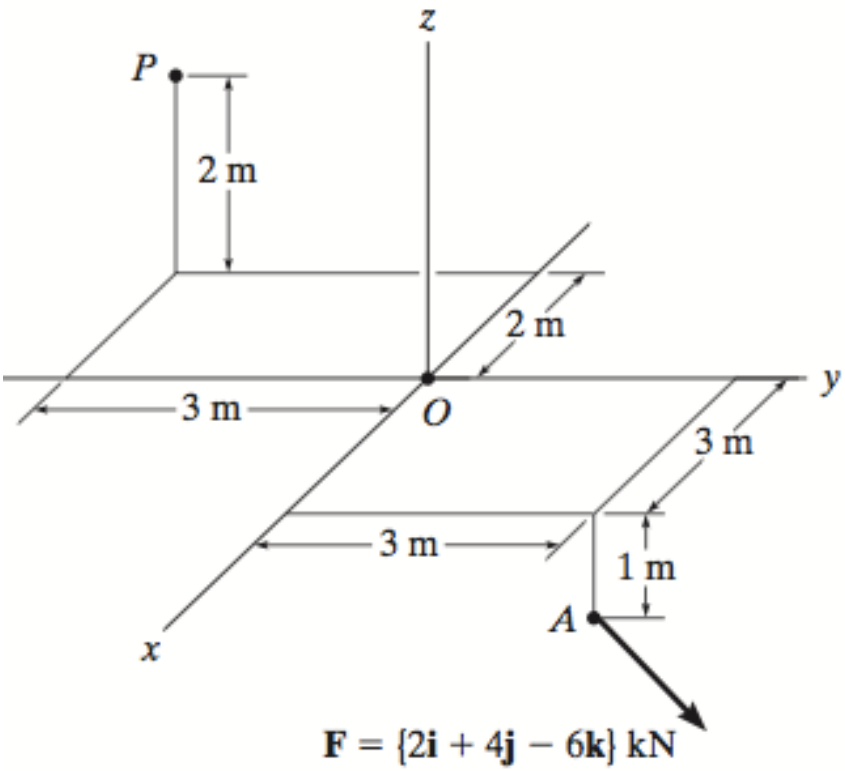


Figure Q2-(a)

(b) The following force system acting on the post as shown in Figure Q2-(c). Calculate and state,

i) the total horizontal component force

(3 marks)

ii) the total vertical component force

(3 marks)

iii) the magnitude and direction of resultant force.

(5 marks)

iv) Length of moment arm that cause a moment at the post AB measured from point A.

(5 marks)

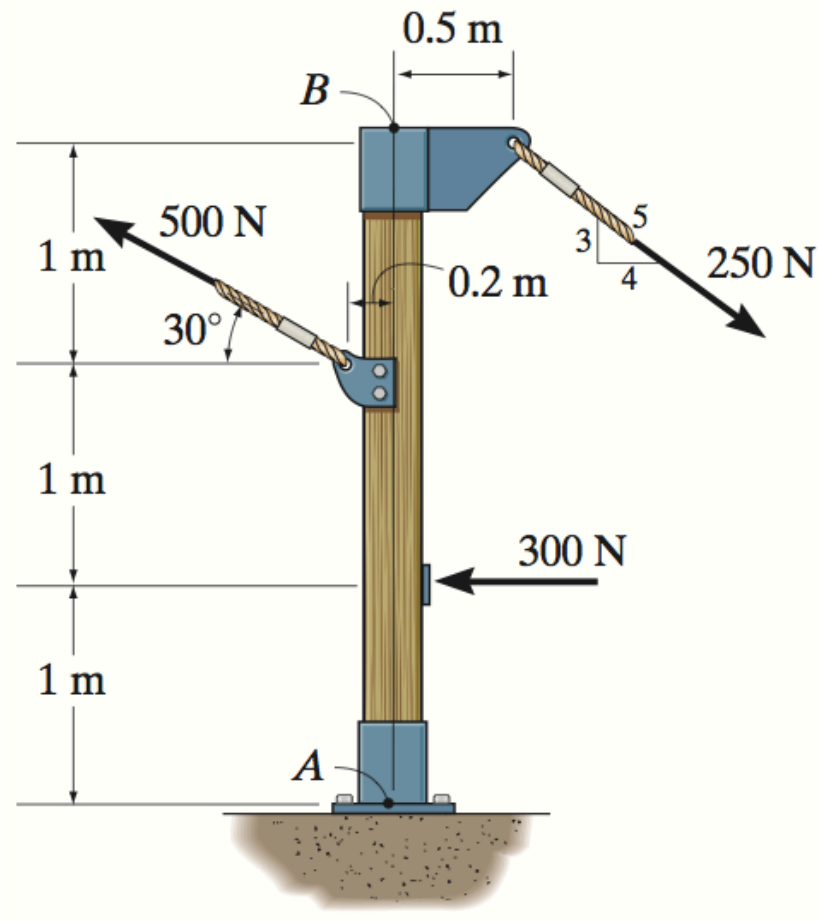


Figure Q2-(b)

Question 3

(a) Determine the reactions at the supports in Figure Q3-(a).

i) Calculate the reaction force at point A,

(6 marks)

ii) Then, reaction force at point B.

(8 marks)

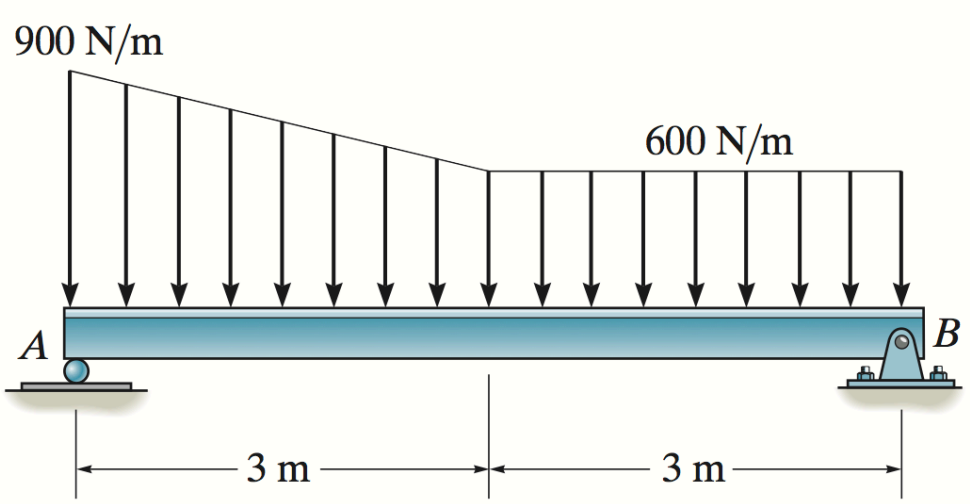


Figure Q3-(a)

(b) Calculate the force in part i), ii) and state if the members are in tension or compression in Figure Q3-(b).

i) Member truss DE,

(5 marks)

ii) Member truss DC.

(6 marks)

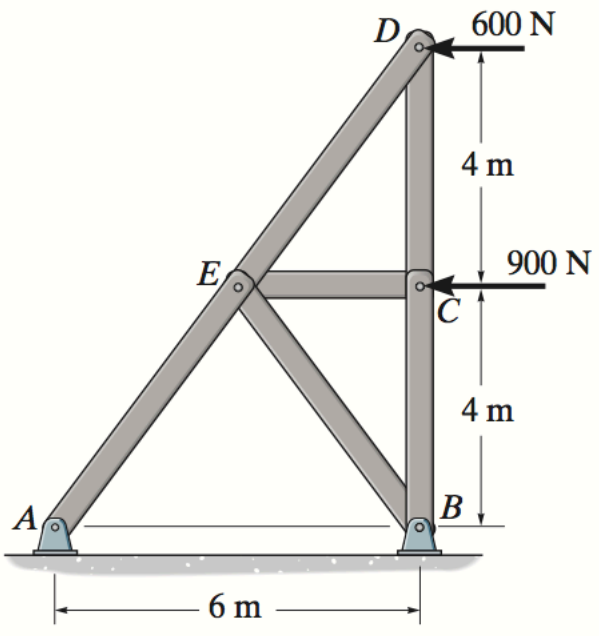


Figure Q3-(b)

Question 4

(a) Locate the centroid $\bar{y}$ of the area cover by the quadratic equation as shown in Figure Q4-(a).

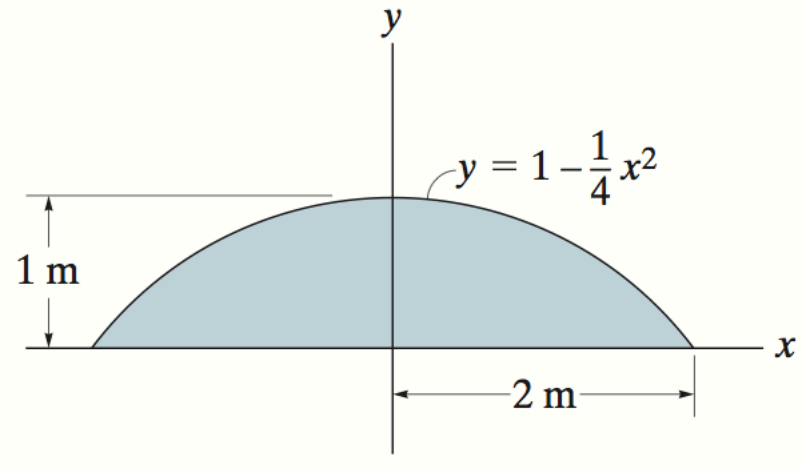


Figure Q4-(a)

(7 marks)

(b) A particle travels along a straight line with velocity as described by the graph in Figure Q4-(b).Construct the acceleration – displacement (a – s) graph.

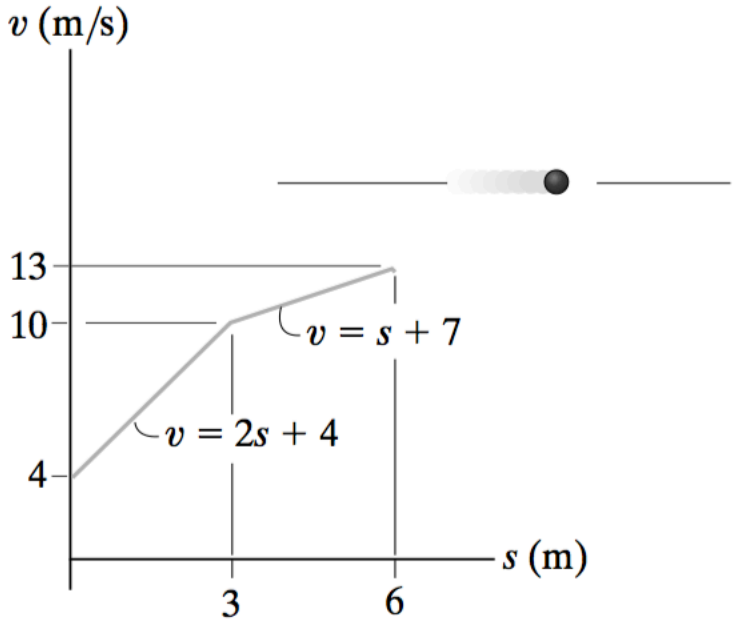


Figure Q4-(b)

(10 marks)

(c) The casting has a mass of 3 Mg as shown in Figure Q4-(d) is suspended in vertical position and initially at rest. It is then given an upward speed of 200 mm/s in 0.3 s using a crank hook *H*.

i) Sketch a free-body-diagram and label all the forces acted onto it.

(2 marks)

ii) Determine the tension in cable *AC* and *AB* during this time interval if the acceleration is constant.

(6 marks)

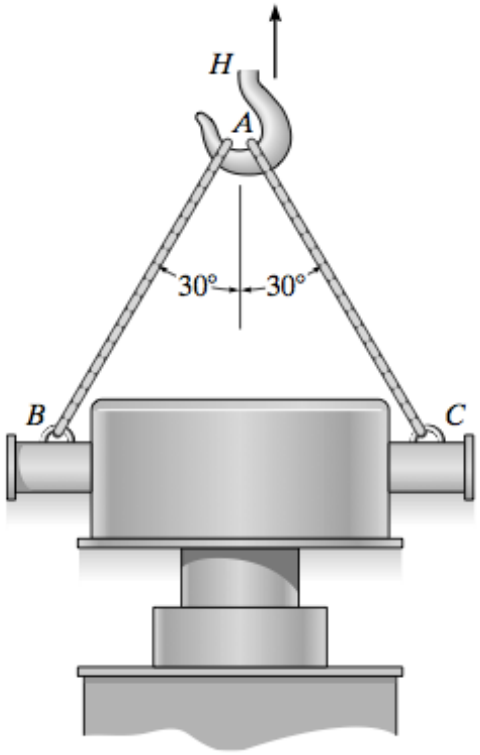


Figure Q4-(c)

Question 5

(a) Determine the moment of inertia about the x axis in Figure Q5-(a) by using the subtraction method.

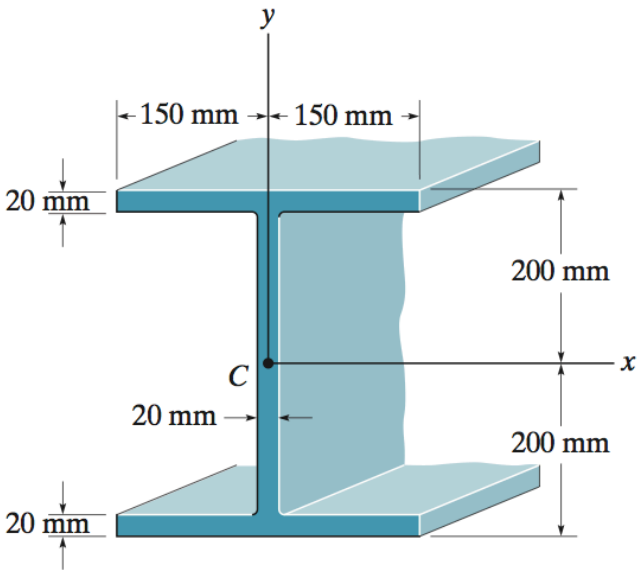
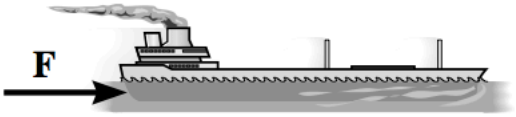


Figure Q5-(a)

(6 marks)

(b) The tanker has a mass of 130 Gg. It is originally at rest. The horizontal trust provided by its propeller varies with time as shown in Figure Q5-(b). Neglect the effect of water resistance. Determine its speed when time, $t = 10$ s.



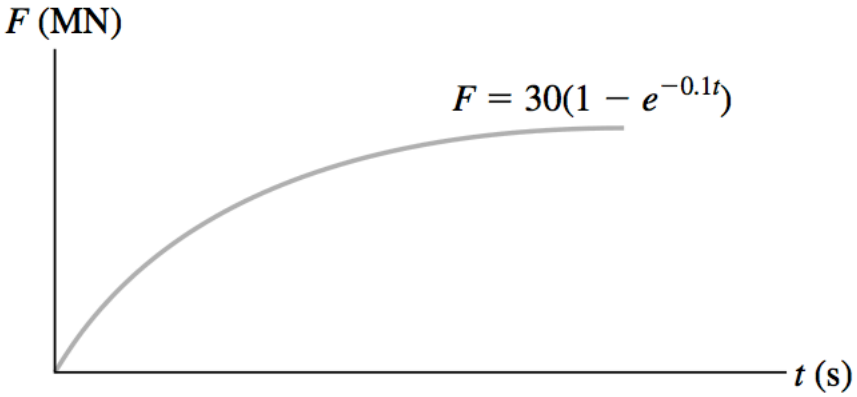


Figure Q5-(b)

(7 marks)

(c) Following question relates to internal forces are based on Figure Q5-(d). Taking the force **P** is 8kN,

i) Determine the tension force develop in the rope.

(4 marks)

ii) Calculate the normal force and hence,

(4 marks)

iii) Calculate the shear force and moment at a section passing through point *C*.

(4 marks)

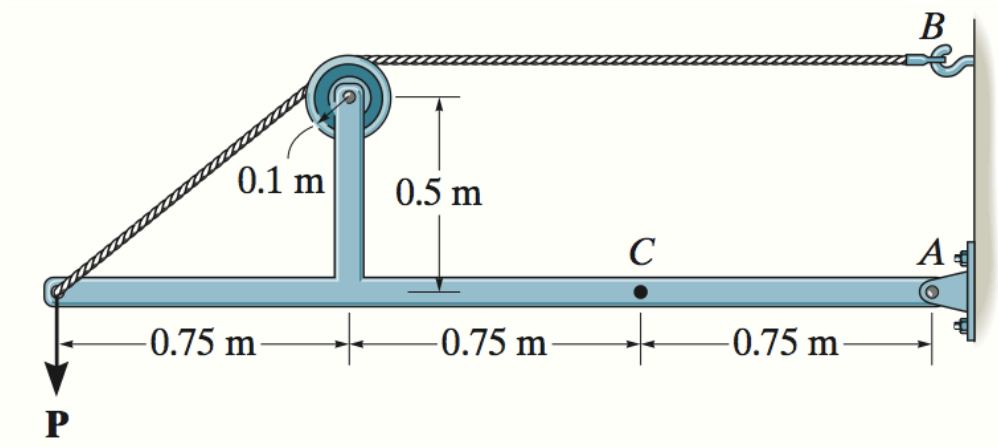


Figure Q5-(c)

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(EGR1203(FINAL)/JAN 2016 /Dr.LIEWSENGCHOY/01032016)