Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	STATICS
COURSE CODE	:	BNJ 10203
PROGRAMME	:	BNK
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY FROM **SIX (6)** QUESTIONS PROVIDED.

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 The bucket as shown in **Figure Q1** has weight $W = 100$ N. Given length a = 0.6m, b = 0.6 m, c = 2.4 m, d = 2.1 m, e = 0.9 m and f = a.

(a) Draw Free Body Diagram of the figure.

(5 marks)

(b) Determine the tension developed in each cord for equilibrium.

(15 marks)

Q2 The mobile crane as shown in **Figure Q2** has weight W_1 and center of gravity at G_1; the boom has weight W_2 and center of gravity at G_2. Given W_1= 600kN, W_2 = 150kN, W = 80kN, a = 1.333·m, b = 2m, c = 1m, d = 4m, e = 5m and θ= 30°. For the calculation, neglect the thickness of the tracks.

(a) Draw Free Body Diagram of the figure.

(5 marks)

(b) If the suspended load has weight W, determine the normal reactions at the tracks A and B.

(15 marks)

Q3 A vertical force **F** acts on the crankshaft shown in **Figure Q3**. The bearings are properly aligned and exert the force reactions on the shaft. Given F = 400N, a = 250mm, b = 350mm, c = 350mm, d = 200mm, e = 150mm and f = 100mm.

(a) Draw Free Body Diagram of the figure.

(2 marks)

(b) Determine the horizontal equilibrium force *P* that must be applied to the handle.

(8 marks)

(c) Determine the *x, y, z* components of force at the smooth journal bearing *A* and the thrust bearing *B*.

(10 marks)

Q4 Three forces acted on the truss that $P_1 = 10$ kN, $P_2 = 20$ kN, $P_3 = 30$ kN as shown in **Figure Q4**. Given a = 1 m, b = 1 m and $\theta = 30°$.

(a) Draw a free body diagram (FBD) to the truss.

(5 marks)

(b) Determine the force in members BC, FC and FE and state if the members are in tension or compression.

(15 marks)

Q5 (a) **Figure Q5 (a)** shows an area which is bounded by x, y axis and a curve with an algebraic equation of $y = ax^2$. Determine in term of a and b:

(i) Area below the curve $y = ax^2$.

(5 marks)

(ii) Locate the centroid of the parabolic area.

(5 marks)

(b) The composite plate as shown in **Figure Q5 (b)** is made from both steel (*A*) and brass (*B*) segments. Given a = 150mm, b = 30mm, c = 225, d = 150mm, $\rho_{st} = 7.85$ Mg/m^3, $\rho_{br} = 8.74$ Mg/m^3 and Mg=1000kg. Determine the mass and location (*x*c, *y*c, *z*c) of its mass center *G*.

(10 marks)

Q6 Blocks *A* and *B* in **Figure Q6** have weight $W_A = 500\ N$ and $W_B = 300\ N$ respectively. Using the coefficients of static friction that given as $\mu = 0.5$, $\mu_{BA} = 0.6$, $\mu_{AC} = 0.4$ and $\theta = 20°$.

(a) Explain briefly the differences between the force static friction and kinetic friction.

(4 marks)

(b) Draw the free body diagram (FBD) of the figure.

(4 marks)

(c) Calculate the greatest weight of block *D* without causing motion. Assume that B slips on A, but A does not move.

(12 marks)

- END OF QUESTION -

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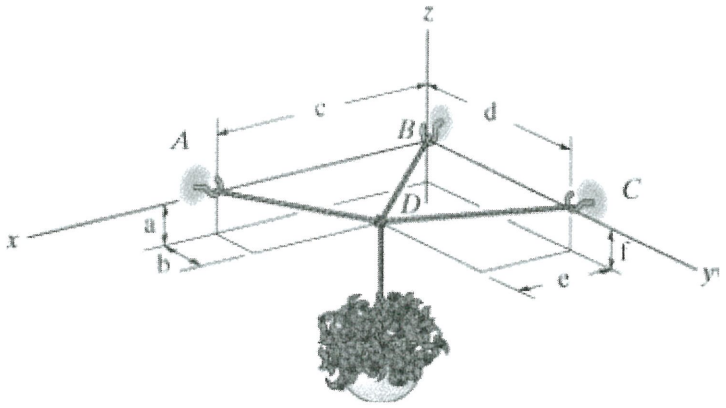

FIGURE Q1

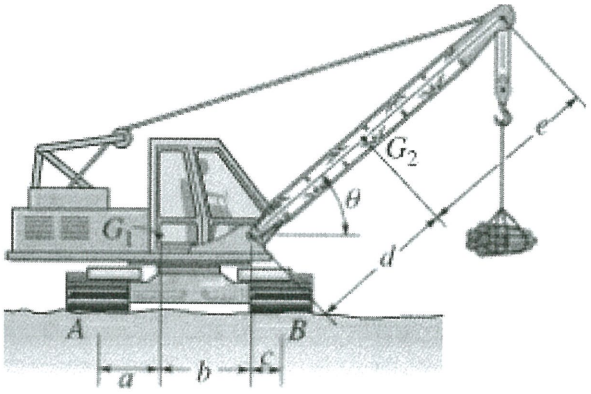

FIGURE Q2

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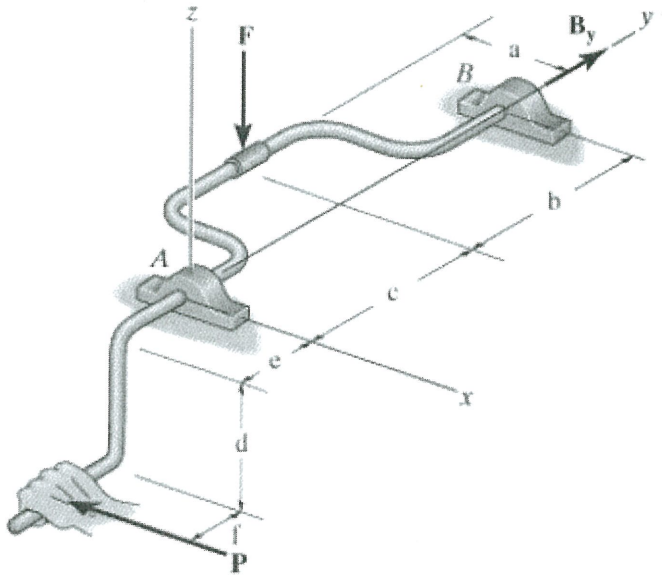

FIGURE Q3

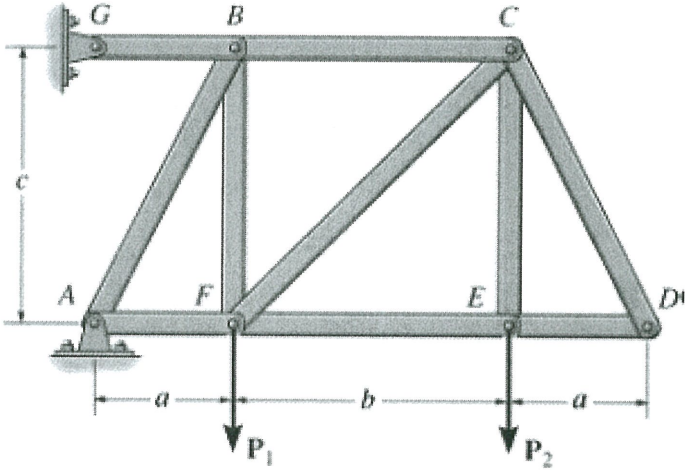

FIGURE Q4

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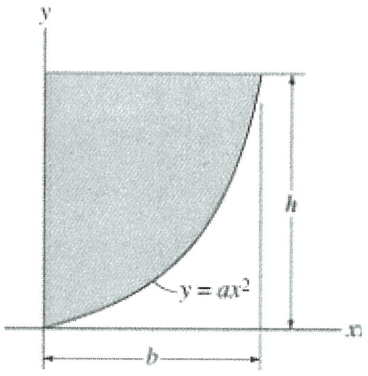

FIGURE Q5 (a)

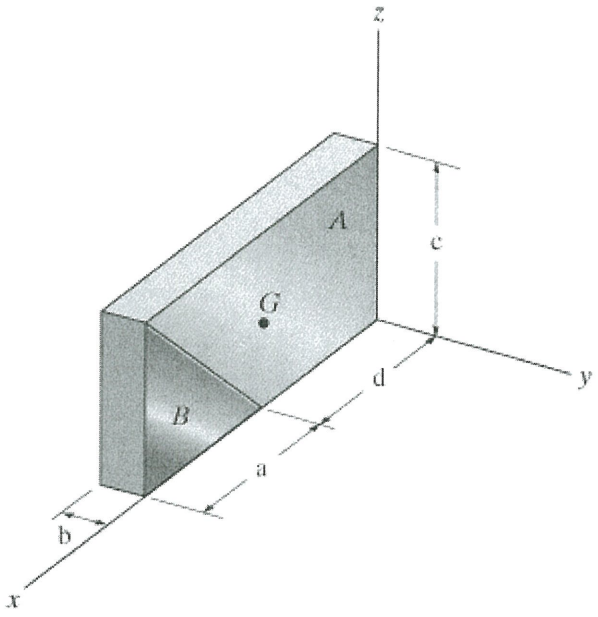

FIGURE Q5 (b)

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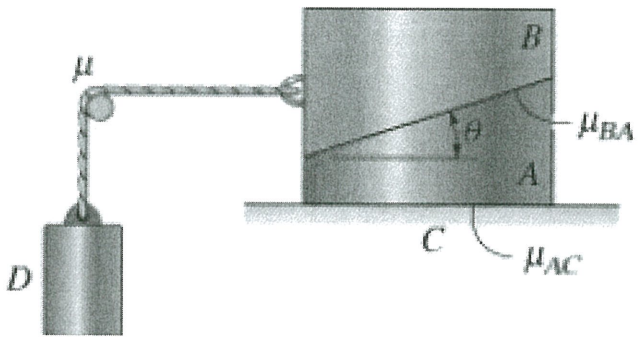

FIGURE Q6