Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	STATICS
COURSE CODE	:	BNJ 10203
PROGRAMME	:	1 BNH / BNL / BNK
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) An object has a weight of 20 mN and 150 kN. Apply appropriate equation to identify the mass in kilograms for both objects and express the answer to three significant figures.

(5 marks)

(b) **FIGURE Q1 (b)** shows an eyebolt subjected with two forces on it, where $T = 6\ kN$ *and* $F = 8\ kN$, $\theta = 30^o$.

(i) Force in plane 2D can be presented by parallelogram and Cartesian vector form in scalar and vector quantities. Write down the differentiation between scalar and vector quantity.

(3 marks)

(ii) By appyling parallelogram method, draw the resultant force action subjected by these two forces on the eyebolt.

(2 marks)

(iii) Determine the magnitude of the resultant force acting on the eyebolt.

(5 marks)

(iv) Calculate the direction measured clockwise from the positive x axis.

(5 marks)

Q2 (a) **FIGURE Q2 (a)** shows two forces acting on the pipe assemby. Express each force in Cartesian Vector Form.

(6 marks)

(b) The gusset plate shows in **FIGURE 2 (b)** is subjected to the forces of four members. The forces are concurrent at point O and stated in equilibrium condition. Take $F = 12\ kN$.

(i) Draw the free body diagram, FBD for the four member of the forces.

(2 marks)

(ii) Determine the force in member B.

(3 marks)

(iii) Calculate its proper orientation, θ for equilibrium.

(3 marks)

(c) Given the pole in **FIGURE 2 (c)** had support a weight of traffic light, W = 100N. By Using Cartesian vectors, determine the moment of the weight of the traffic light about the base of the pole at A. Given $a = 3.6\ m$, $b = 5.4\ m$, *and* $\theta = 30^o$.

(6 marks)

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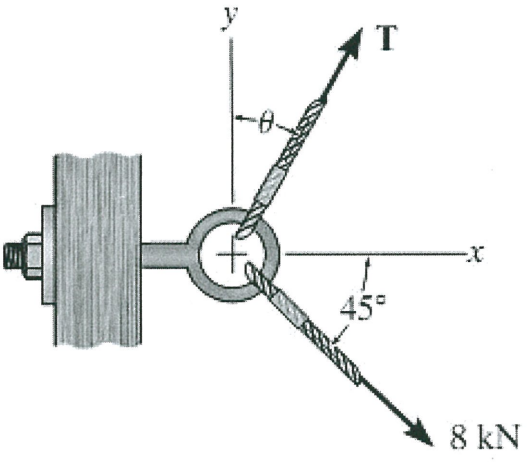
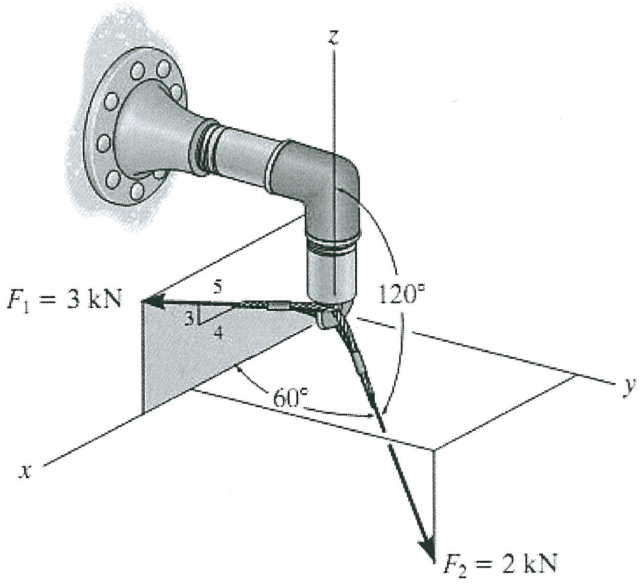


FIGURES Q1 (b)



FIGURES Q2 (a)

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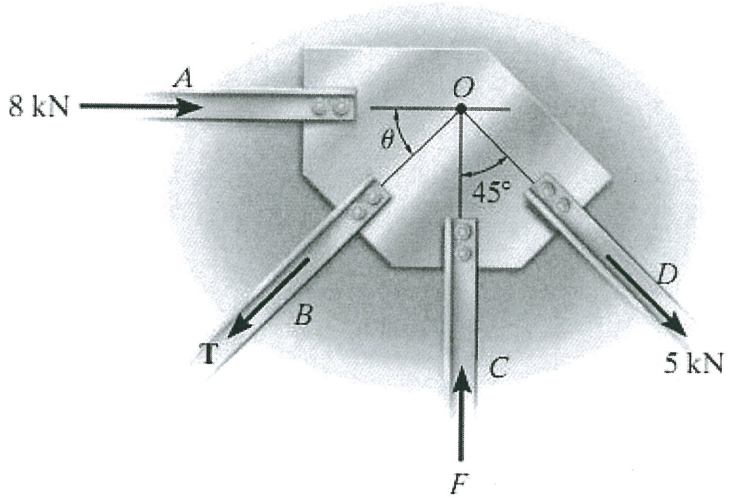
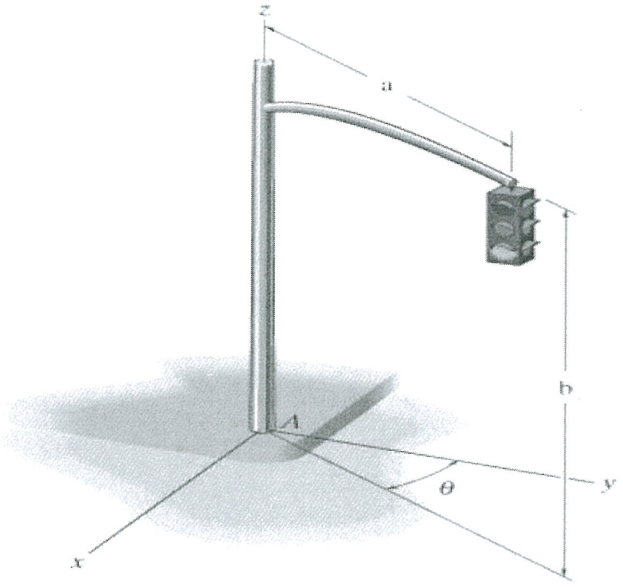


FIGURES Q2 (b)



FIGURES Q2 (c)

Q3 (a) Handle forces F_1 and F_2 are applied to the electric drill as in **FIGURE Q3 (a)**. Equivalent system can be achieved by determine the single force and couple moment. Given $F_1 = \{6\,\boldsymbol{i} - 3\,\boldsymbol{j} - 10\,\boldsymbol{k}\}\ N$, $F_2 = \{2\,\boldsymbol{j} - 4\,\boldsymbol{k}\}\ N$.

(i) Give the definition for couple moment with the aid of diagram.

(2 marks)

(ii) Calculate the equivalent resultant force.

(2 marks)

(iii) Determine the equivalent resultant couple moment at point O.

(6 marks)

(b) **FIGURE Q3 (b)** a beam with distributed loading. Replacement of the distributed loading by an equivalent resultant force can be made by applying the equivalent system. Given $w_1 = 800N/m$, $w_2 = 200N/m$, $a = 2m$, *and* $b = 3m$.

(i) Carry out the equivalent resultant force by the distributed loading.

(6 marks)

(ii) Calculate the location of equivalent resultant force, measured from point *A*.

(4 marks)

Q4 (a) Draw the free-body diagram of the uniform beam shown in the **FIGURE 4 (a)** and have a fixed support at point A. The beam has a mass of 100 kg.

(5 marks)

(b) The truss, used to support a balcony, is subjected to the loading shown in **FIGURE Q4 (b)**. Approximate each joint as a pin. Given $P_1 = 800kN$, $P_2 = 0\ kN$, $a = 4m$.

(i) Explain briefly the difference between truss, frame and machine in engineering mechanics.

(3 marks)

(ii) Determine the force in member AD and AB.

(5 marks)

(iii) Carry out the value for the force in member BC and BD.

(5 marks)

(iv) State whether the members are in tension or compression.

(2 marks)

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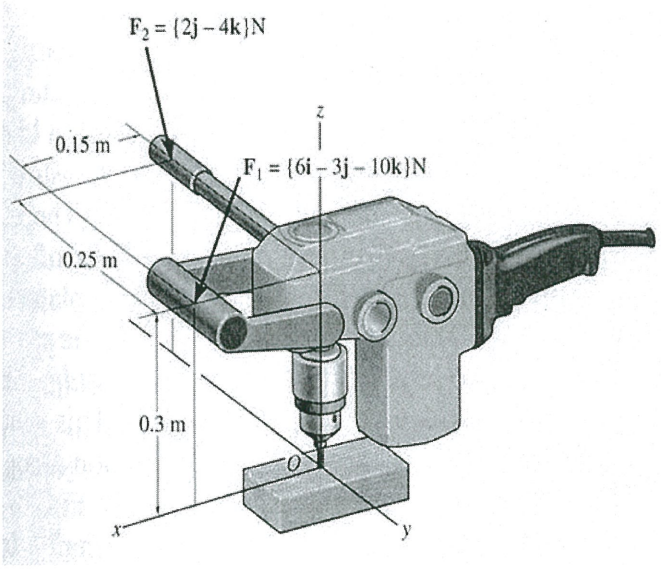
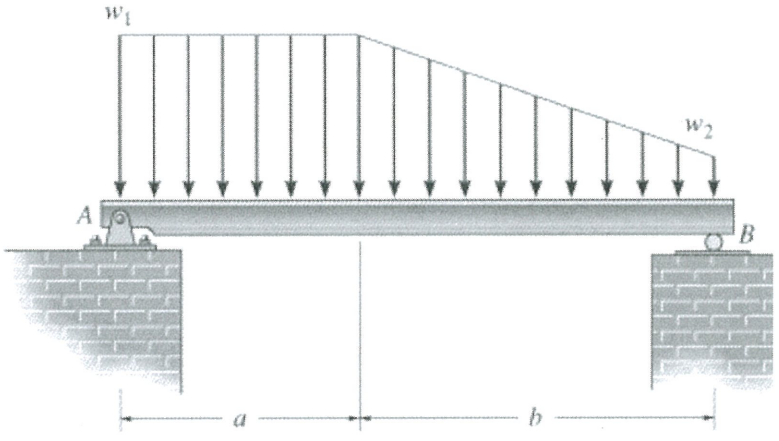


FIGURES Q3 (a)



FIGURES Q3 (b)

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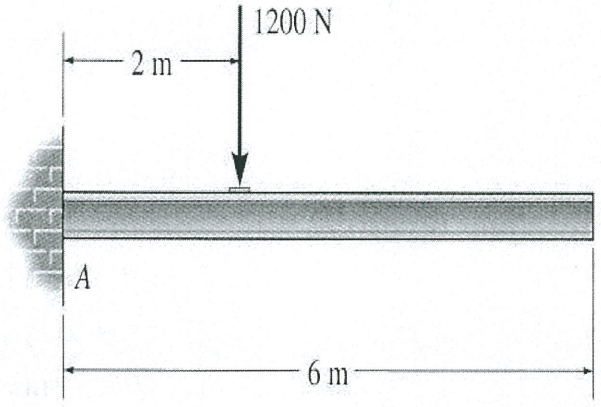
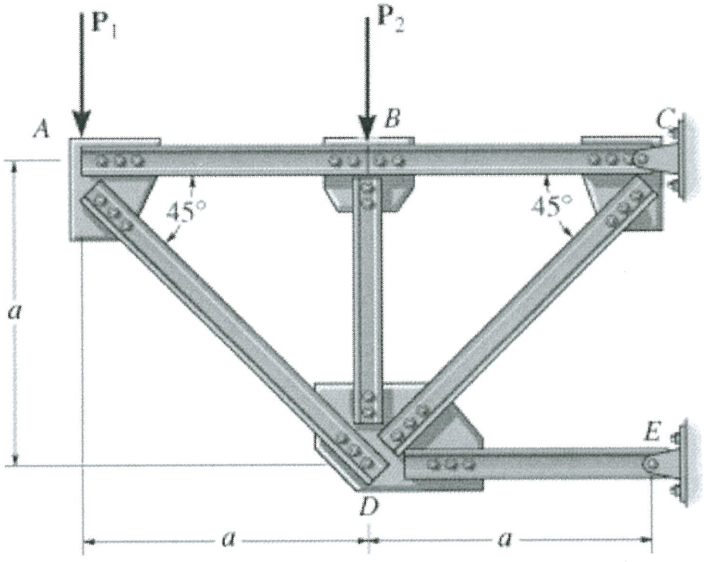


FIGURES Q4 (a)



FIGURES Q4 (b)

Q5 (a) Derived the concept of center of gravity and center of mass with the aid of diagram.
(6 marks)

(b) Method of Integration used to detemine the location of the centroid while theorem of Pappus–Guldinus used to determine the area and volume for a surface of revolution. Given $xy = c^2$, $a = 0.5m$, $b = 2m$, and $c = 1m$ in **FIGURE Q5 (b)**:

(i) Determine the area and the centroidal distance y of the shaded area by using the method of intergration.
(10 marks)

(ii) Calculate the volume of a solid formed by revolving the area about the x axis using the second theorem of Pappus–Guldinus,
(4 marks)

Q6 (a) State the Coulomb friction definition and describe **THREE (3)** various kind of friction?
(4 marks)

(b) **FIGURE Q6 (b)** show the uniform dresser that has a weight $W_{dresser} = 360N$ and rests on a tile floor for which the coefficient of friction is $\mu_s = 0.25$. If the man pushes on it in the direction, $\theta = 30^o$ and he has a weight $W_{man} = 600N$:

(i) Draw the free body diagram, FBD of the uniform dresser and the man.
(4 marks)

(ii) Find the smallest magnitude of force F needed to move the dresser.
(6 marks)

(iii) Determine the smallest coefficient of static friction between the man shoes and the floor so that he does not slip.
(6 marks)

- END OF QUESTION -

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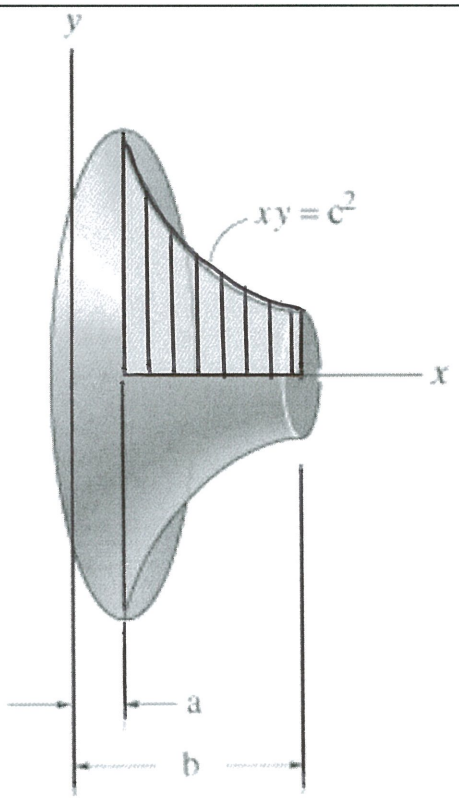
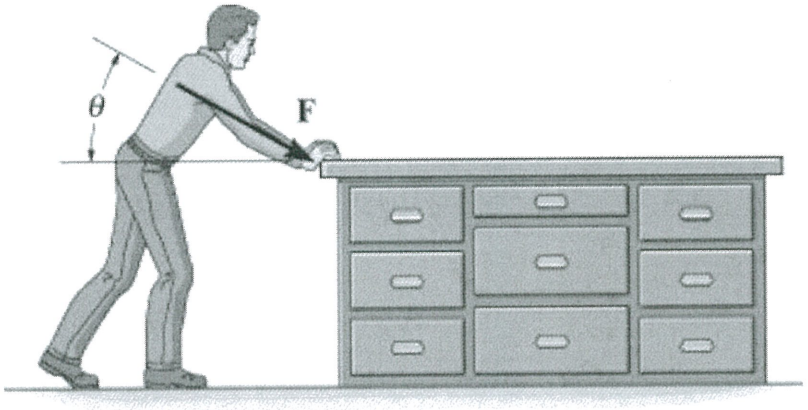


FIGURES Q5 (b)



FIGURES Q6 (b)