Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER II
## SESSION 2014/2015

| | | |
|---|---|---|
| NAME OF COURSE | : | STATICS |
| COURSE CODE | : | BDA10203 |
| PROGRAM | : | 1 BDD |
| DATE OF EXAMINATION | : | JUNE 2015/ JULY 2015 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **FIVE (5)** QUESTIONS FROM **SIX (6)** QUESTIONS PROVIDED |

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

**Q1.** (a) Define the following terms in engineering:-

(i) Static
(ii) Particle
(iii) Rigid body
(iv) First Newton Law

(4 marks)

(b) Convert each of the following and express with SI units having an approximate prefix:

(i) (50 mN)(6 GN)
(ii) (400 mm)(0.6 MN)$^2$
(iii) 45 MN$^3$/900 Gg

(6 marks)

(c) The two forces **F**1 and **F2** acting on the eyebolt as shown in **Figure Q1**.

(i) Resolve the forces into components acting along the *x* and *y* axes
(ii) Determine the magnitudes of the these components
(iii) Explain if the angle of $\alpha$ is increase.

(10 marks)

**Q2** The pipe is subjected to the force of **F** as shown in **Figure Q2.**

a) Represent the position vectors $r_{AB}$ in cartesian vector form.

(3 marks)

b) Find the magnitude of the position vector $|\, r_{AB} \,|$

(3 marks)

c) Find the unit vector $U_{AB}$ describing the line's direction

(4 marks)

d) The magnitude of the force, **F** acting along the axis AB of the pipe.

(4 marks)

e) Describe what happen if the vector $r_{AB}$ changed to the vector $r_{BA}$

(6 marks)

**Q3** The resultant couple moment of the two couples that act on the pipe assembly as shown in **Figure Q3**. If the distance from *A* to *B* is d = 400 mm. Determine,

a) The resultant couple moment of the system

(12 marks)

b) The moment in a Cartesian vector.

(8 marks)

**Q4** (a) (i) Determine the force in each member of the truss as shown in **Figure Q4(a).**

(ii) State if the members are in tension and compression and explain why.

(8 marks)

(b) **Figure Q4 (b)** shows the truss acted upon by the horizontal and vertical external force.

(i) Find the forces in member ED

(ii) Calculate the force in member EH

(iii) Determine the force in member GH.

(iv) State if the members above are in tension and compression and explain why.

(12 marks)

**Q5**. (a) (i) Give the definition of Centroid of an Area.

(ii)Referring to **Figure Q5 (a)**, calculate the centroid $(\bar{x}, \bar{y})$ of the composite area.

(10 marks)

(b) (i) Give the definition of second theorem of Pappus and Guldinus.

(ii) **Figure Q5 (b)** shows the thin-wall tank is fabricated from a hemisphere and cylindrical shell. Determine the vertical reactions that each of the four symmetricallyplaced legs exerts on the floor if the tank contains water which is 3.6 m deep in the tank. The specific gravity of water is 10 kN/m$^3$. Neglect the weight of the tank.

(10 marks)

**Q6** A support block is acted upon by the two forces as shown in Figure Q6. The coefficients of friction between the block and the incline plane are $\mu_s$= 0.35 and $\mu_k$= 0.25.
The effectiveness of the support can be determined by three conditions, first to start the block moving up the inclined plane, second to keep it moving up and third to prevent it from sliding down. According to this three conditions, find the following;

(a) Draw the free body diagram for all three cases.

( 4 marks)

(b) Determine the force P required to accomplish each condition

(10 marks)

(c) What will happen if this support is applied with 800N of force P and calculate the new coefficients of friction between the block and the incline plane.

(6 marks)

***-END OF QUESTIONS-***

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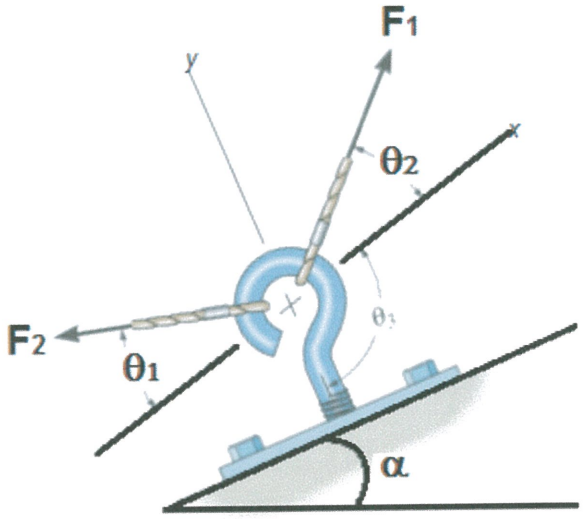


**Figure Q1**

**Given:**

**F** := 80N **c** := 12m

**a** := 4m **d** := 2m

**b** := 3m **e** := 6m

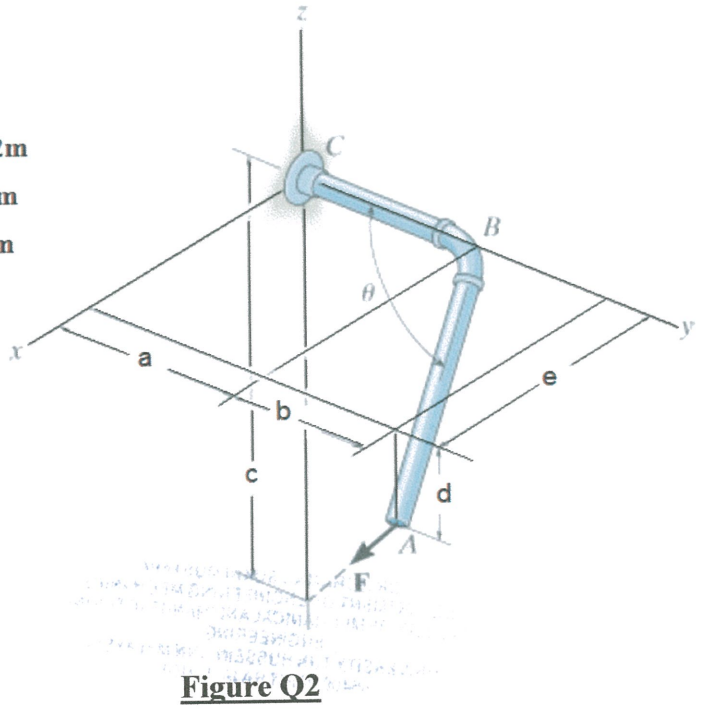


**Figure Q2**

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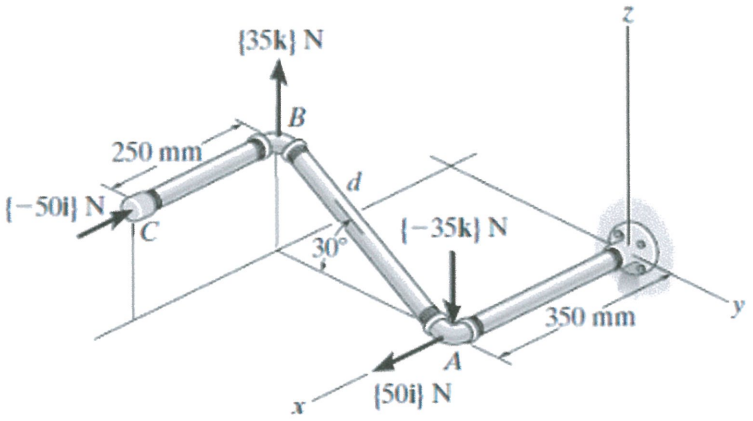


**Figure Q3**

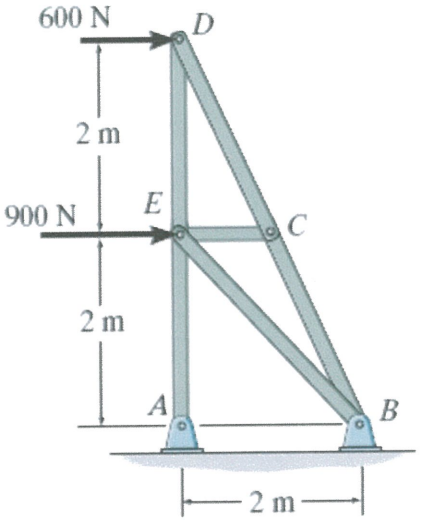


**Figure Q4(a)**

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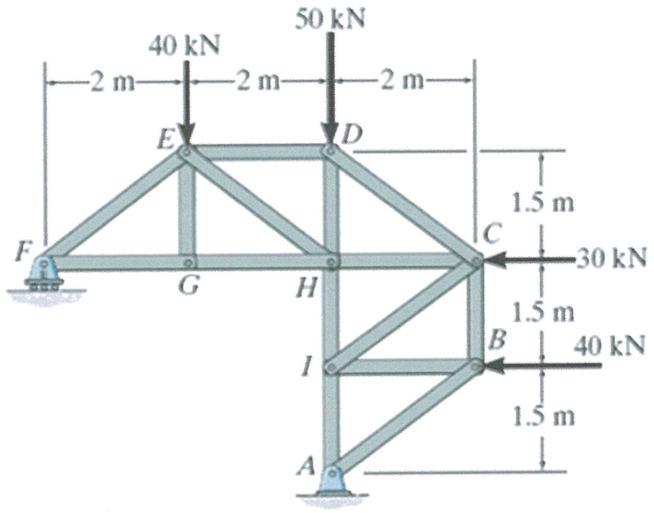


**Figure 4(b)**

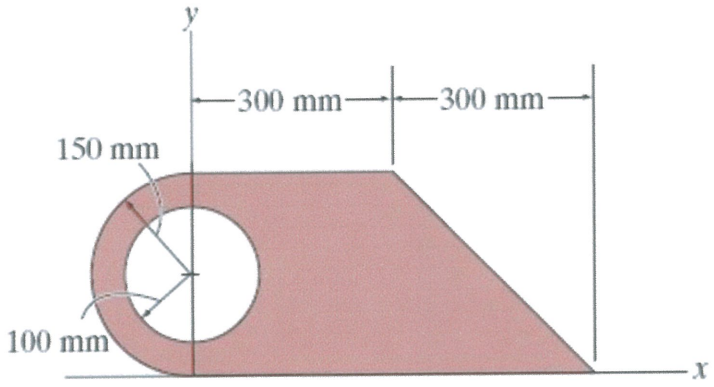


**Figure Q5 (a)**

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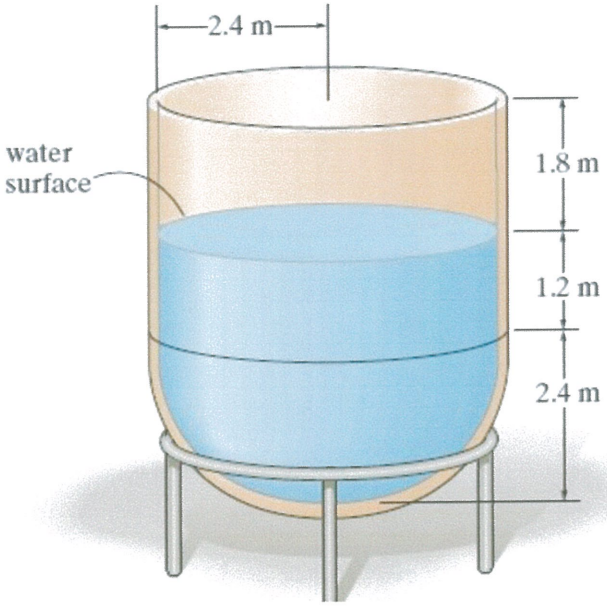


**Figure Q5(b)**

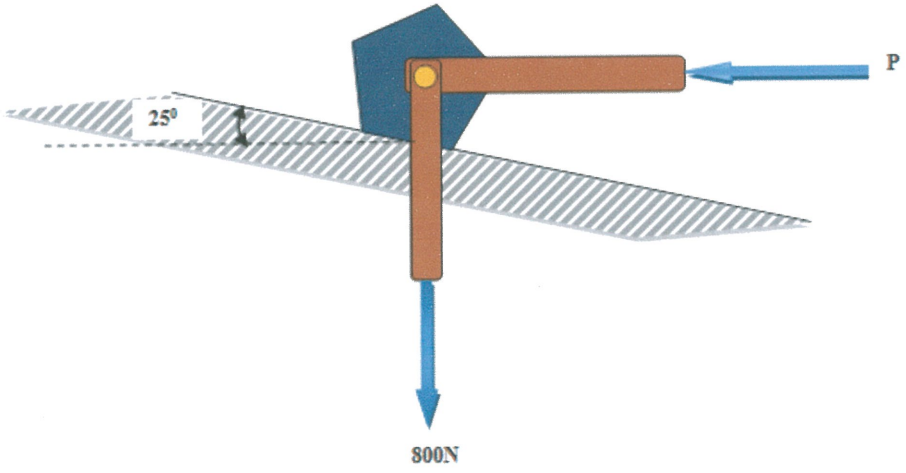


**Figure Q6**

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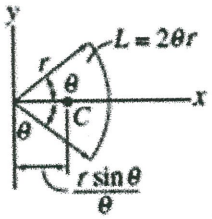
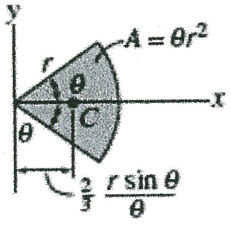
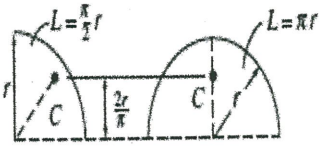


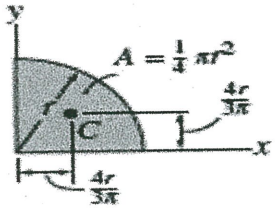

Circular arc segment



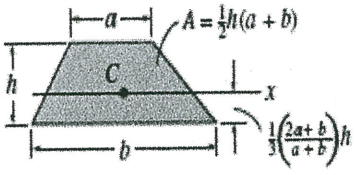

Circular sector area



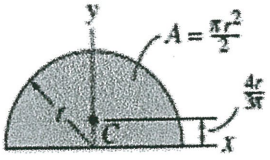

Quarter and semicircle arcs



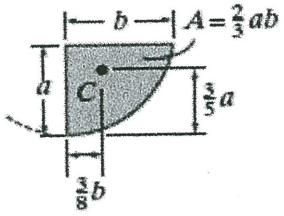

Quarter circle area



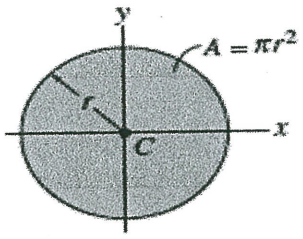

Trapezoidal area



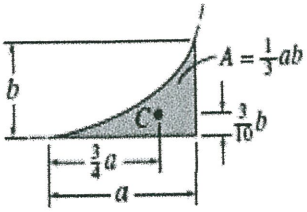

Semicircular area



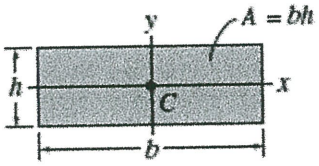

Semiparabolic area



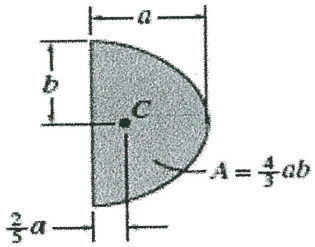

Circular area



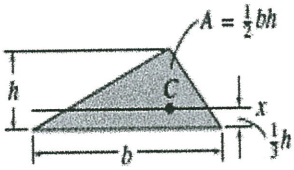

Exparabolic area




Rectangular area




Parabolic area




Triangular area