UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	STATIC
COURSE CODE	:	BNP 10102
PROGRAMME	:	1 BNA/BNB/BNC
EXAMINATION DATE	:	DECEMBER 2016/JANUARY 2017
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

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Q1 (a) Describe and give the examples about *vector* and *scalar*.

(6 marks)

(b) **Figure Q1 (b)** show a beam weights balanced on a round barrel supporting a man and his daughter. If man weight 74 kg, calculate the weight of his daughter and the supporting barrel.

(8 marks)

(c) Analyse the resultant of the coplanar force system shown in **Figure Q1 (c)** that consist of four forces and one couple. Find the location of resultant and show your answer with a sketch of coordinate system.

(11 marks)

Q2 (a) Explain the principles of moments.

(6 marks)

(b) **Figure Q2 (b)** show a man pulling on the rope wrapped around the homogenous drum with 3600 N drum rolling down the inclined surface. If the pull exerted by the man is 560 N:
   (i) Sketch the free body diagram for that situation
   (ii) Determine the angle of the incline.
   (iii) Solve the reaction at the base of drum.

(Note: Assume that there is enough friction to prevent the drum and the man from slipping)

(10 marks)

(c) The homogenous 120 kg wooden beam in **Figure Q2 (c)** is suspended from ropes at point A and B. A power wrench applies the 500 Nm clockwise moment to tighten a bolt at C.
   (i) Sketch the free body diagram for this situation.
   (ii) Determine the tension in the ropes.

(9 marks)

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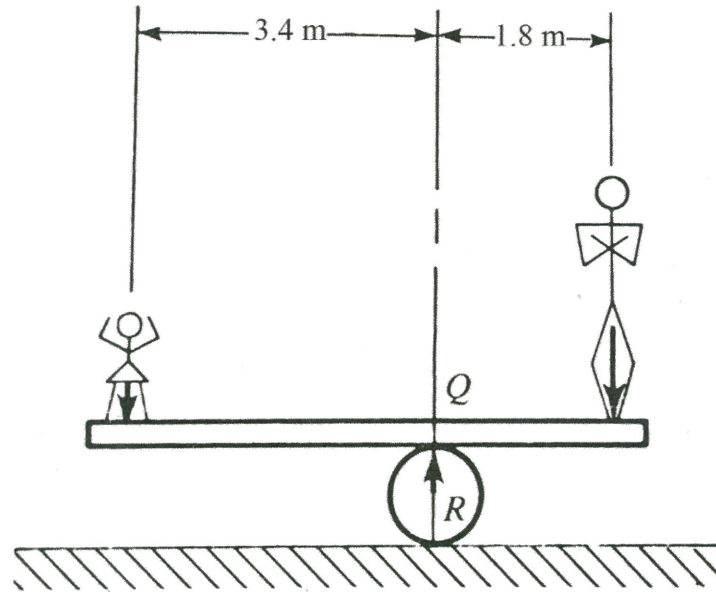
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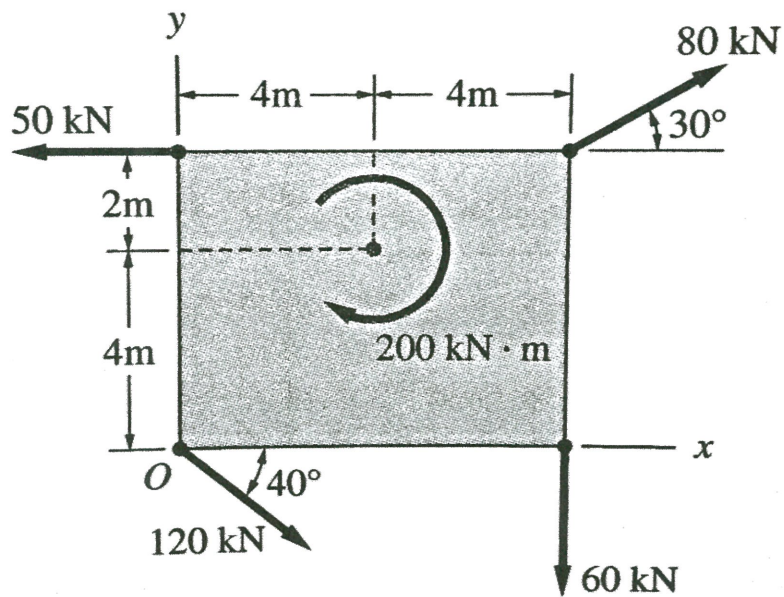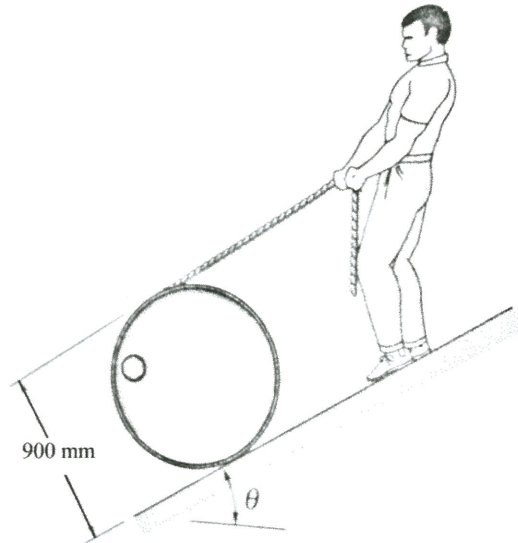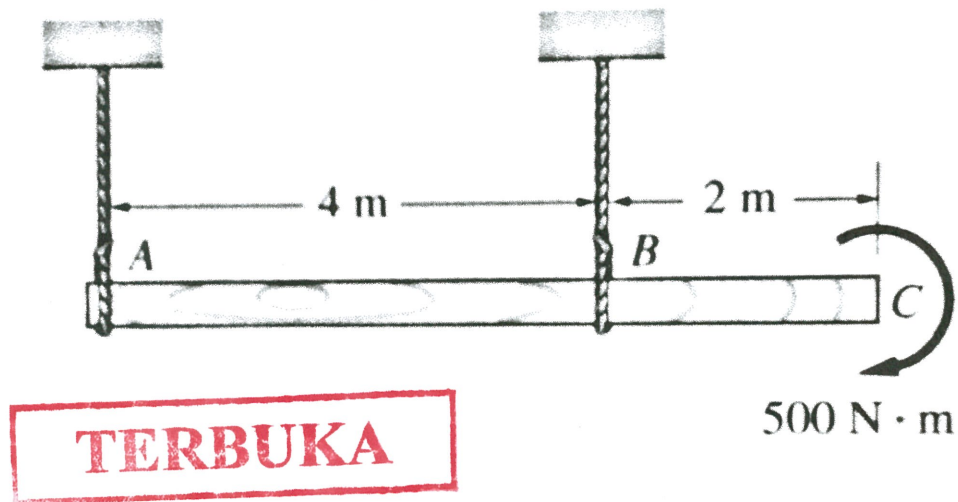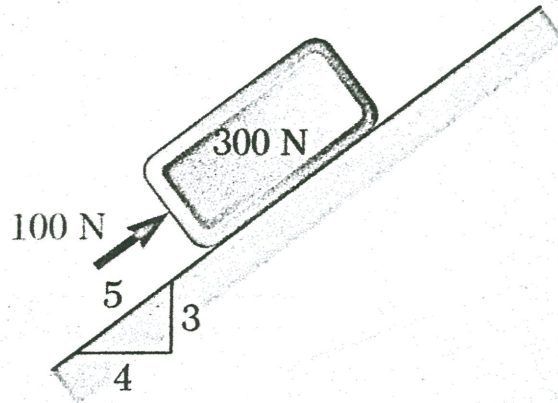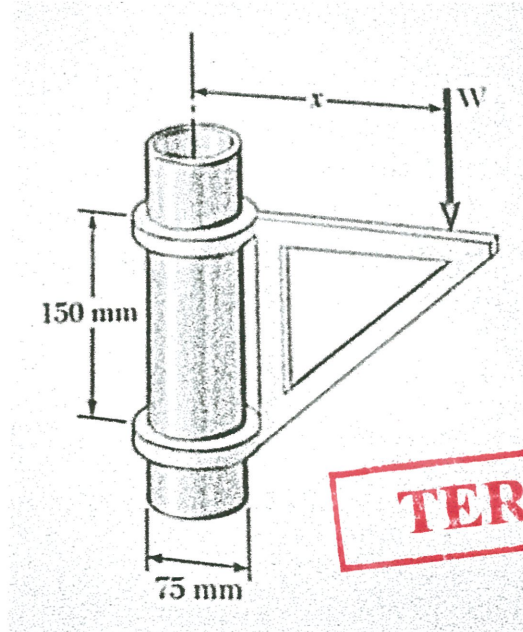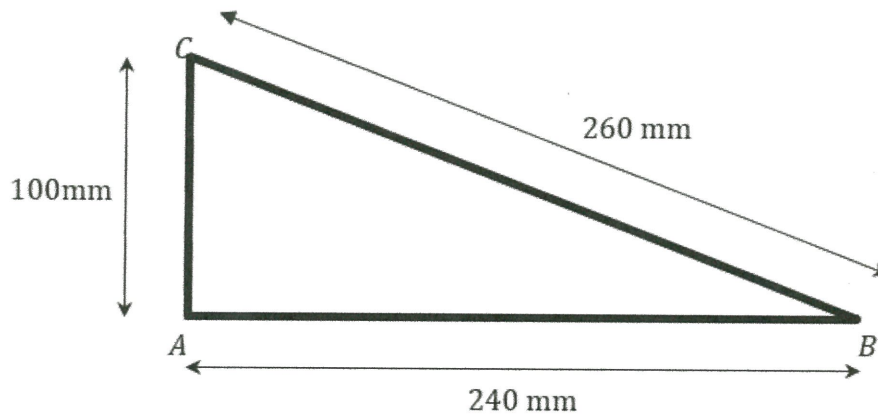COURSE CODE: BNP10102

FIGURE Q1 (b)

FIGURE Q1 (c)

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FIGURE Q2 (b)

500 N · m

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FIGURE Q2 (c)

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Q3   (a)   Briefly explain the friction law and its basic mechanism.

(5 marks)

      (b)   A 100 N force in **Figure Q3 (b)** is exerted on 300 N block placed on an inclined plane. The coeffient of friction between the block and the plane are $\mu_s = 0.25$ and $\mu_k = 0.20$. Analyse whether the block is in equilibrium, and find the value of the friction force.

(10 marks)

      (c)   The movable bracket in **Figure Q3 (c)** may be placed at any height on the 75 mm diameter pipe. If the coefficient of static friction between the pipe and bracket is 0.25, analyse the minimum distance x at which the load W can be supported. Neglect the weight of bracket.

(10 marks)

Q4   (a)   Give a definition of "centre of gravity" then list and explain three main types of centroid.

(5 marks)

      (b)   The **Figure Q4 (b)** is made from a piece of thin, homogeneous wire. Determine the location of its center of gravity.

(8 marks)

      (c)   Based on **Figure Q4 (c)** analyse:
(i) The First Moment with respect to the x and y axes
(ii) The Location of the centroid

(12 marks)

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FIGURE Q3(b)

FIGURE Q3(c)

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FIGURE Q4 (b)

$r_1 = 60mm$
$r_2 = 40mm$
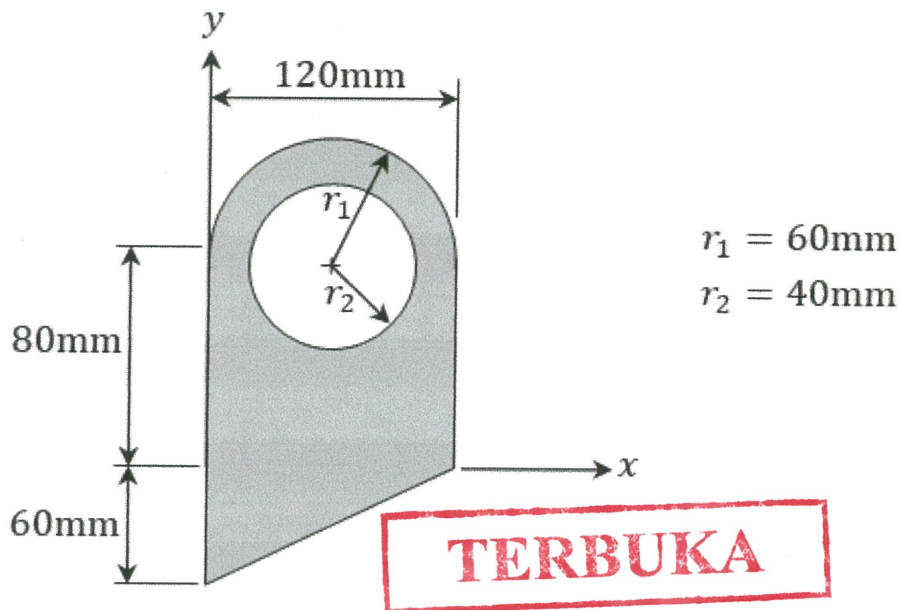
FIGURE Q4 (c)

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Q5   (a)   Give a definition of "Moment of Inertia".

(3 marks)

(b)   Based on **Figure 5 (b)** analyse the moment of inertia of the composite area shown about the x-axis.

(9 marks)

(c)   **Figure 5 (c)** shows the cross section of I beam, based on that figure:

(i) Determine the moment of inertia about the x and y axes with respect to x and y axes through the centroid of the area. Simply considers the centroid of area lies at the same point of neutral axis.

(9 marks)

(ii) Calculate the radius of gyration of the composite areas by using the moment of inertia above.

(4 marks)

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- END OF QUESTION -

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100 mm

75 mm

75 mm

FIGURE Q5 (b)

20

20

320

20

260
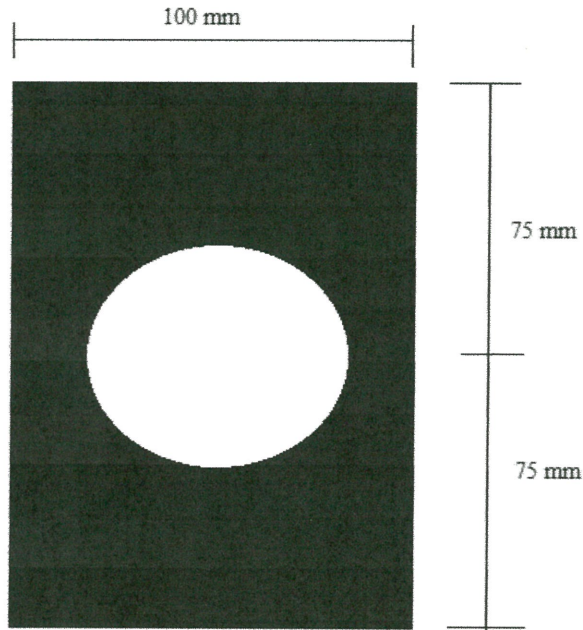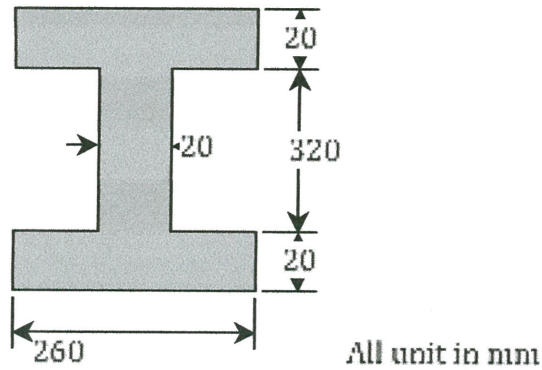
All unit in mm

FIGURE Q5 (c)

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