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Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2021/2022**

COURSE NAME : STATIC AND DYNAMIC  
COURSE CODE : BFC 10103  
PROGRAMME CODE : BFF  
EXAMINATION DATE : JULY 2022  
DURATION : 3 HOURS  
INSTRUCTION

1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

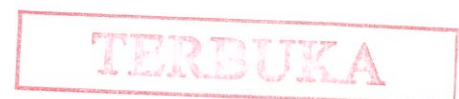
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- Q1** (a) Discuss the importance of unit in measurements. (2 marks)
- (b) **Figure Q1(a)** shows point A is inside the square BCDE whose side length is 20. The length of AB is 9 and the length of AE is 13. Find the length of AC, x. All units in cm. (5 marks)
- (c) Calculate the x and y components of the forces as shown in **Figure Q1(b)**. Then, conclude the resultant forces for all systems. (8 marks)
- (d) **Figure Q1(c)(i) to Figure 1(c)(iii)** shows the real structures that can be found in real world. You are assigned to transform into free body diagrams in two dimensional model include the structural elements such as beams, columns and trusses and loads subjected to body weight and supports. Any assumptions also can be made. (10 marks)
- Q2** (a) Define whether the force in **Figure Q2(a)(i) to Figure Q2(a)(iv)** is couple or not couple. State your reason. (8 marks)
- (b) Referring to **Figure Q2(b)**;
- (i) Determine load, P if the total moment about point B is 1009Nm with anticlockwise direction. (8 marks)
- (ii) By considering load P that you obtained from **Q2(b)(i)**, prove the total moment about point A is 412Nm with anticlockwise direction. (5 marks)
- (iii) Show the couple forces and justify your reason in choosing that forces. (4 marks)
- Q3** (a) Discuss **TWO (2)** relationship between centroid and moment of inertia in structural engineering. (4 marks)
- (b) Describe the meaning of the following items:
- (i) Center of mass
- (ii) Centroid
- (iii) Composite area (6 marks)



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- (c) A prestressed concrete section is shown in **Figure Q3(b)**. Determine the moment of inertia about the centroidal axis  $x$  and  $y$ . Assume the centroid  $(\bar{x}, \bar{y})$  of the prestressed concrete section is located at  $\frac{1}{2}$  of the bottom flange width from datum  $y$  and  $\frac{1}{3}$  of the overall depth from datum  $x$ .
- (15 marks)

- Q4** (a) (i) Derive the equation of  $W = \frac{1}{2} m(v^2 - u^2)$  using the relationship between Work and Kinetic Energy.
- (5 marks)

- (ii) Three small sphere A, B and C have the same radius with a mass of 8kg, 10kg and 13kg were arranged in order on a smooth horizontal line as shown in **Figure Q4(a)**. At the beginning, B in a rest position and A sphere were moved with the velocity of  $5u$  direct to B sphere while C sphere were moved with the velocity of  $u$  leave out the B sphere. The elastic coefficient between A and B is  $\frac{3}{4}$  and the elastic coefficient between B and C is  $\frac{1}{2}$ . Determine the loss of energy at the first collision between A and B sphere.
- (5 marks)

- (b) Explain the principle of Newton Motion Law based on **Figure Q4(b)**.
- (5 marks)

- (c) An object has a mass of 8kg and is placed on a horizontal and smooth table. The mass is connected with another mass of 5kg which attached with inelastic light tie rod and passing through a smooth pulley at the end of the table. If the system is released, determine:

- (i) The acceleration of the object
- (5 marks)

- (ii) The tension at tie rod
- (5 marks)

**-END OF QUESTIONS-**

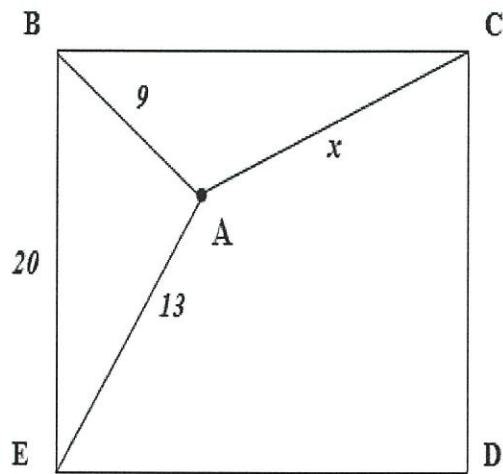
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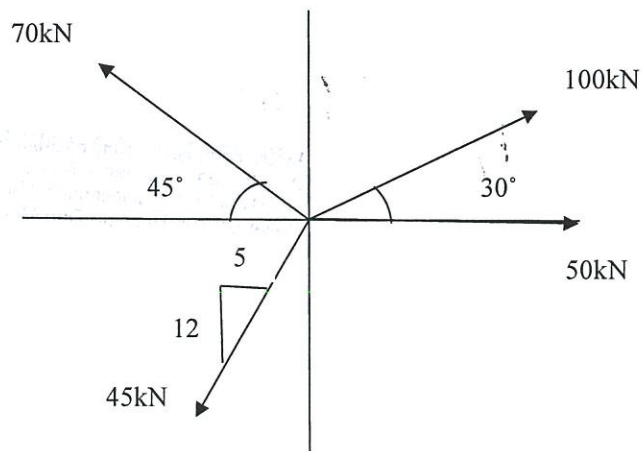
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**FIGURE Q1(a)**



**FIGURE Q1(b)**

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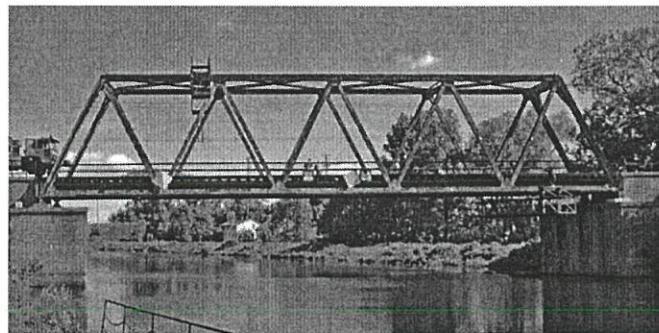
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**FIGURE Q1(c)(i)**



**FIGURE Q1(c)(ii)**

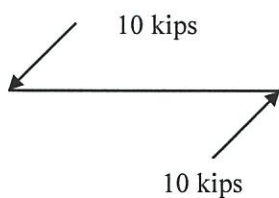


**FIGURE Q1(c)(iii)**

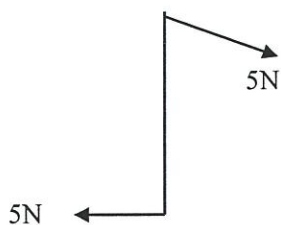
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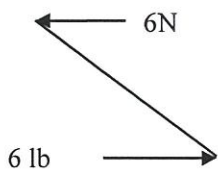
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**Figure Q2(a)(i)**



**Figure Q2(a)(ii)**



**Figure Q2(a)(iii)**



**Figure Q2(a)(iv)**

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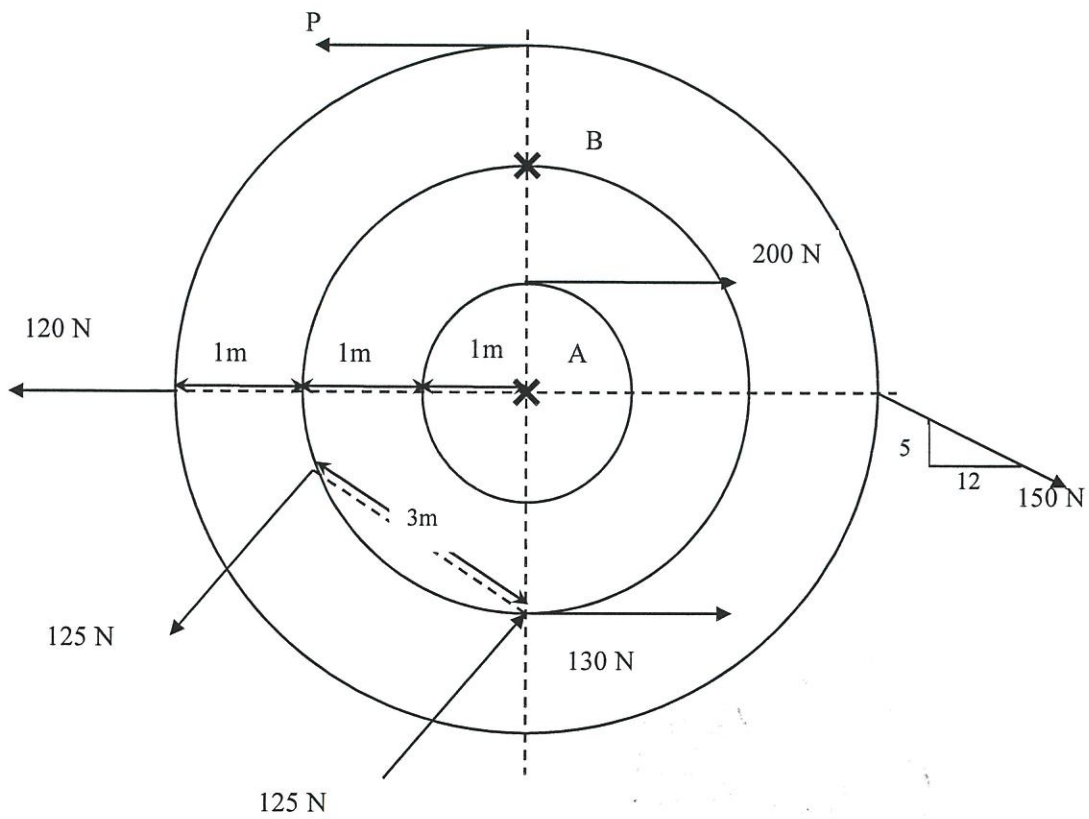


FIGURE Q2(b)

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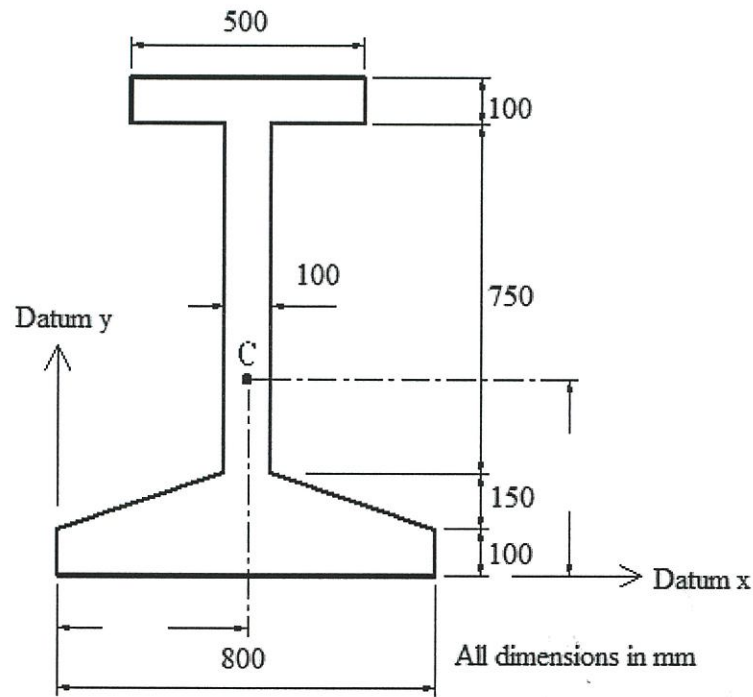


FIGURE Q3(a)

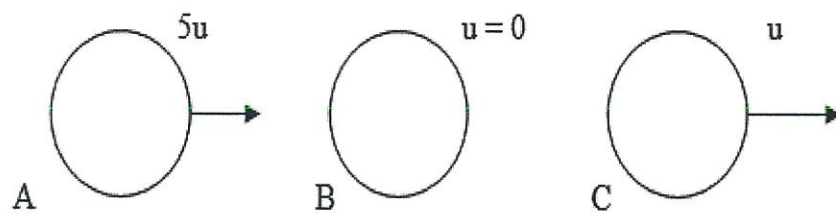


FIGURE Q4(a)

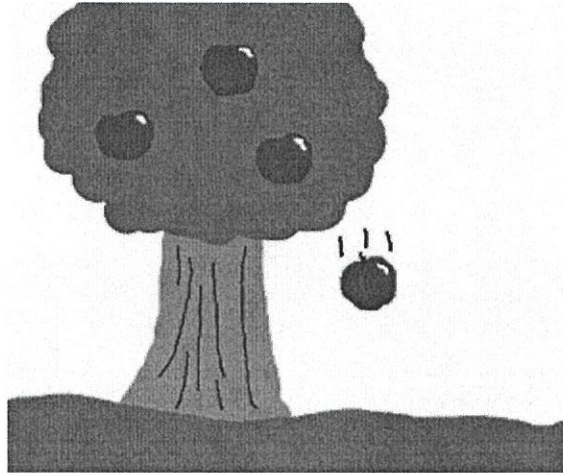




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**FIGURE Q4(b)**