Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 1
SESSION 2021/2022

COURSE NAME	:	STATIC AND DYNAMIC
COURSE CODE	:	DAC11803
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS FROM **PART A** AND **TWO (2)** QUESTIONS FROM **PART B** 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED **VIA OPEN BOOK**

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

PART A

Q1 (a) **Figure Q1(a)** shows a weight D supported by two (2) cables AB and AC. A force F act horizontally on the system at buckle A to maintain static equilibrium. If mass of D = 20 kg and force of F = 300 N:

(i). Draw the free body diagram of the particle in the system by showing all relevant magnitudes and direction of forces.

(4 marks)

(ii). Write all available static equilibrium equations for the system.

(4 marks)

(iii). Calculate the magnitude of tensile forces in cable AB and cable AC.

(4 marks)

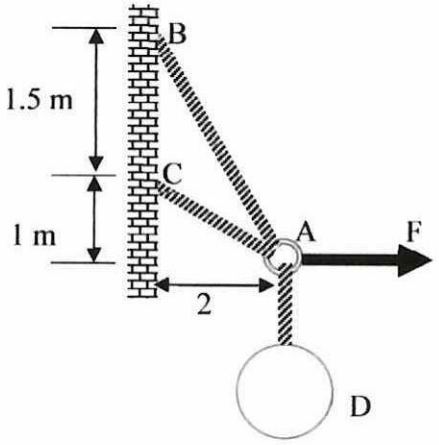

Figure Q1(a)

(b) **Figure Q1(b)** shows a ring A act upon by force of 8 kN and unknown force **T**. The resultant force of the system is known to act in positive x direction with magnitude of 9 kN.

(i). Draw the parallelogram of all the forces that act on the ring.

(3 marks)

(ii). Calculate the magnitude and direction (θ) of force T.

(4 marks)

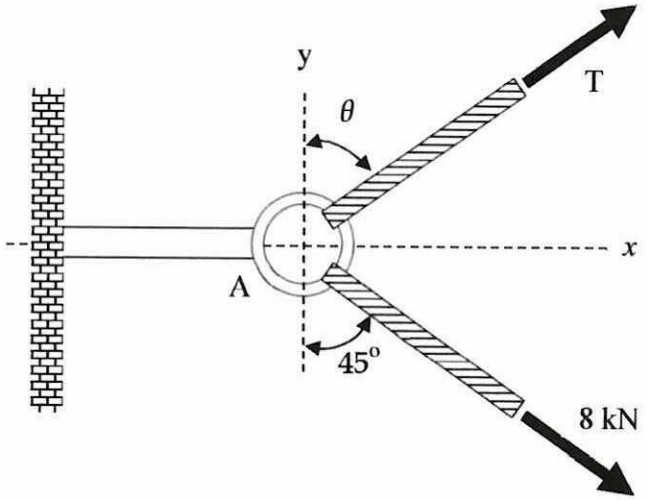

Figure Q1(b)

(c) Represent each of the following combinations of units in the correct SI form using an appropriate prefix:

(i) Mg/mm,

(2 marks)

(ii) mN/μs,

(2 marks)

(d) Convert 12 ft/h to mm/s. Express the result to three significant figures. Use an appropriate prefix.

(2 marks)

Q2 (a) **Figure Q2 (a)** shows an assembly of column and beam subjected with various forces.

(i) Calculate the magnitude resultant moment at point C.

(2 marks)

(ii) Calculate distance x as shown in figure and calculate the magnitude resultant moment at point A.

(3 marks)

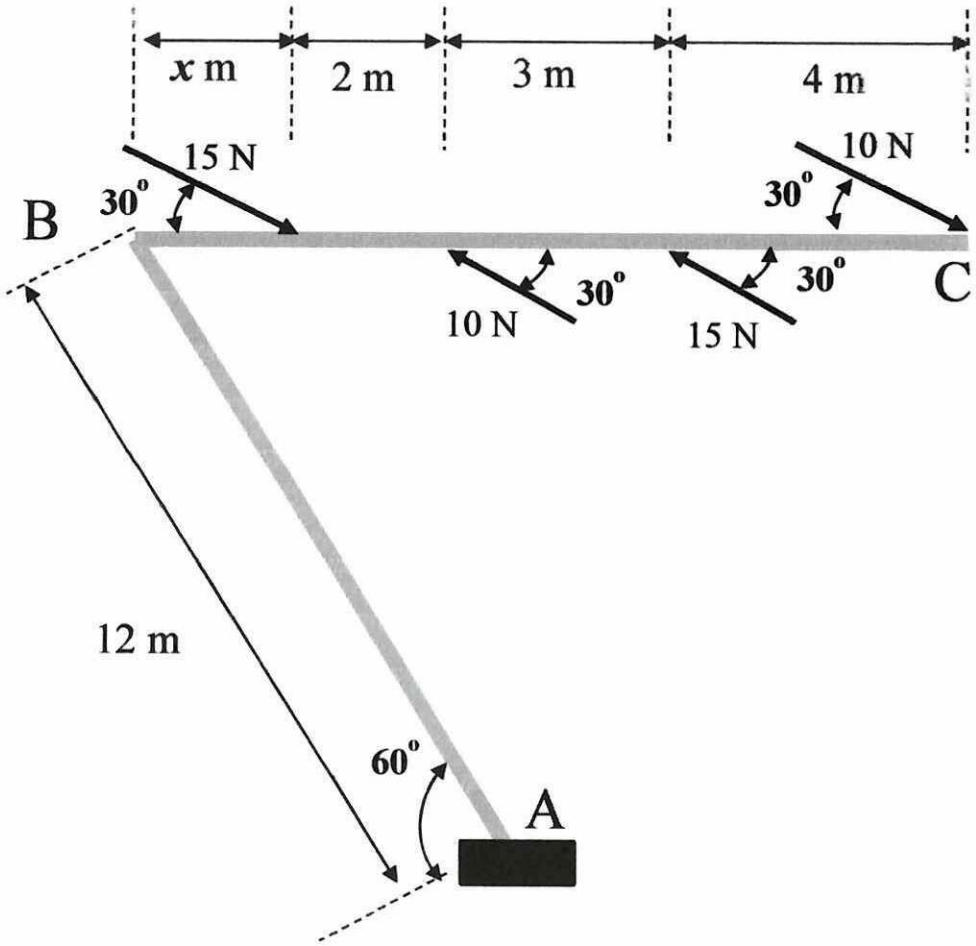

Figure Q2(a)

(b) **Figure Q2 (b)** shows a moment and forces system acting on a plane.

(i) Calculate the sum of moment at point P generate by 60 N and 140 N forces only.

(3 marks)

(ii) Calculate the sum of moment at point P generate by 40 N.m moment only.

(2 marks)

(iii) Replace the force and couple moment system by an equivalent force and couple moment acting at point P

(3 marks)

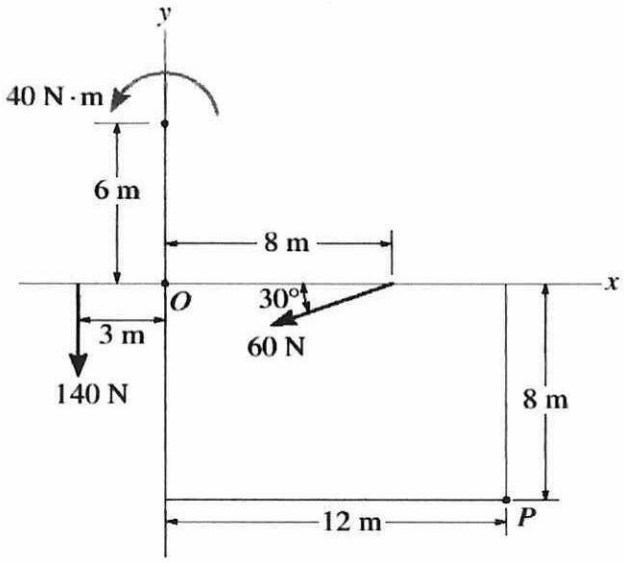

Figure Q2 (b)

(c) **Figure Q2(c)** shows an L frame which is fixed to a wall at A. Three (3) forces act on the frame as shown.

(i) Calculate the sum of moment at point A

(4 marks)

(ii) Replace the force system acting on the frame by an equivalent resultant of force and couple-moment acting at point A.

(4 marks)

(iii) Replace the force system acting on the frame by an equivalent resultant of a single force acting along member AB. Show the location, magnitude and direction of the force.

(4 marks)

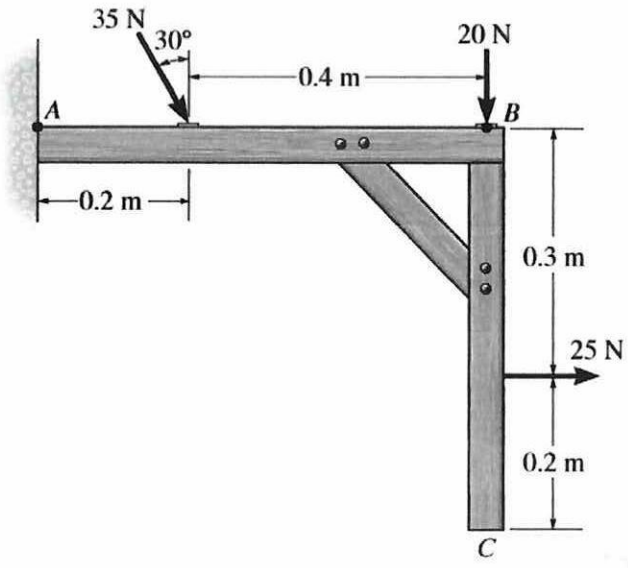

Figure Q2 (c)

PART B

Q3 (a) **Figure Q3(a)** shows a 220 kg box resting on an inclined surface of 35° from horizontal. The coefficient of static friction between the box and the inclined surface is 0.25. A force P is applied on the box at a direction parallel to horizontal.

(i) Draw the free body diagram of the system complete with magnitudes and directions of forces.

(5 marks)

(ii) Write all relevant equations of equilibrium for the systems.

(4 marks)

(iii) Calculate the magnitude of horizontal force P that is required to start an upward movement of the box.

(4 marks)

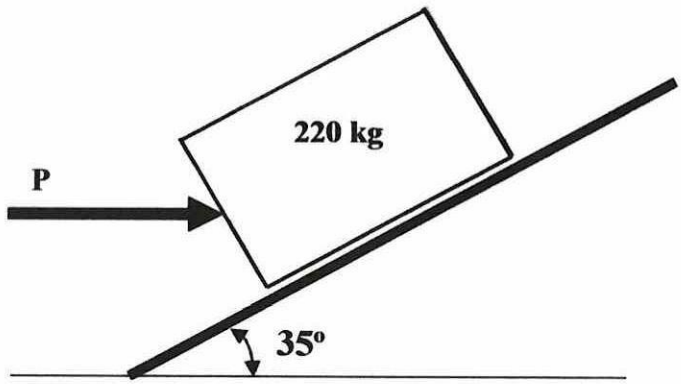

Figure Q3(a)

(b) **Figure Q3(b)** shows a rigid body ABCDE simply supported by pin at C and roller at D.

(i) Draw the free body diagram for the rigid body..

(4 marks)

(ii) Write all equations of equilibruim for the rigid body..

(4 marks)

(iii) Calculate and determine all reactions at C and D

(4 marks)

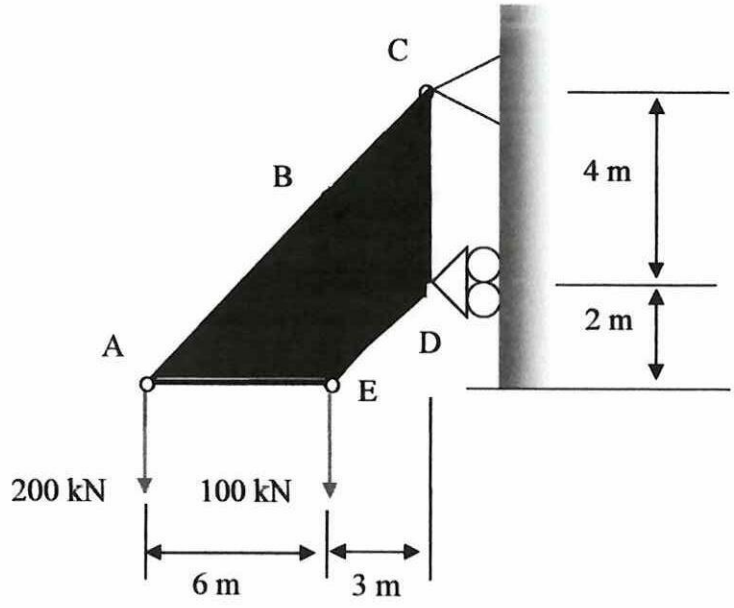

Figure Q3(b)

Q4 (a) **Figure Q4 (a)** shows a 6 m length simply supported beam AB loaded with linearly distributed load (LDL).

(i) Locate the position of the centroids of the LDL on the simply supported beam.

(6 marks)

(ii) Draw the free body diagram of the beam with the LDL replaced by a equivalent point load. Show the magnitude, direction and location of the point load.

(5 marks)

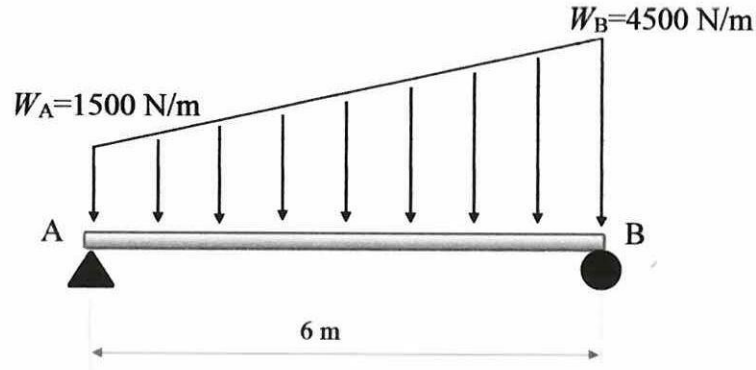

Figure Q4 (a)

(b) **Figure Q4 (b)** shows a composite shape assemble from various basic geometric shape. Break the composite into **three (3)** basic shape only and :

(i) Calculate the total value of the first moment of an area for the individual shape with respect to x axis.

(5 marks)

(ii) Calculate the total value of the first moment of an area for the individual shape with respect to y axis.

(5 marks)

(iii) Calculate the area of the shaded shape and coordinate of the centroid with respect to origin.

(4 marks)

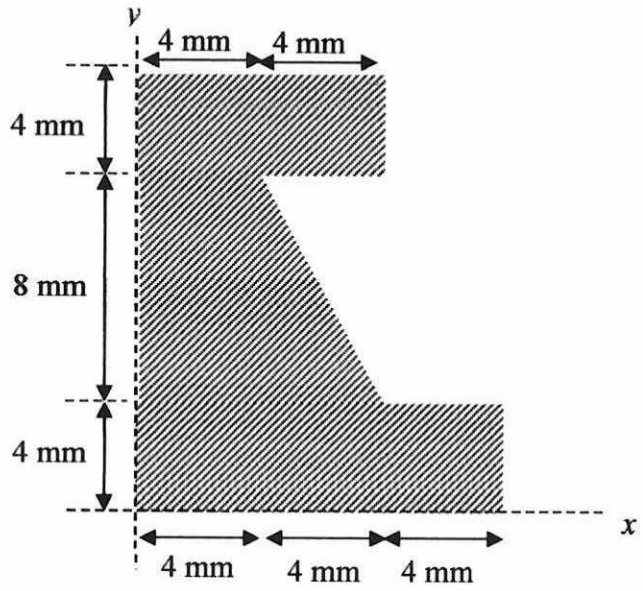

Figure Q4 (b)

Q5 (a) **Figure Q5 (a)** shows a cross section of a rectangular beam with round hollow part in the middle.
Calculate:

(i) Moment of inertia of the section with respect to its centroidal y axis.

(4 marks)

(ii) Moment of inertia of the section with respect to its centroidal x axis.

(4 marks)

(iii) Moment of inertia of the section with respect to y axis

(4 marks)

(iv) Moment of inertia of the section with respect to x axis.

(4 marks)

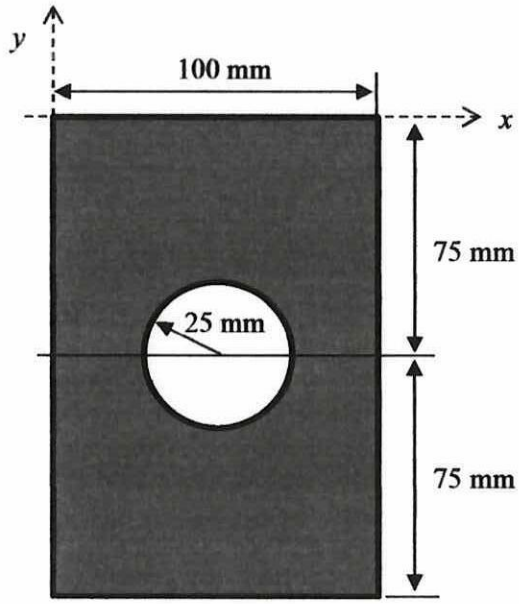

Figure Q5 (a)

(b) **Figure Q5 (b)** shows a composite shape formed by joining a rectangle shape (A) with a semi circle section (B). The centroid of the composite shape is at unknown coordinate of (x,y).

(i) Calculate the moment of inertia of the composite shape with respect to a line that is parallel with ***x*** axis and passing through its own centroid.

(4 marks)

(ii) Calculate the moment of inertia of the composite shape with respect to ***x*** axis.

(5 marks)

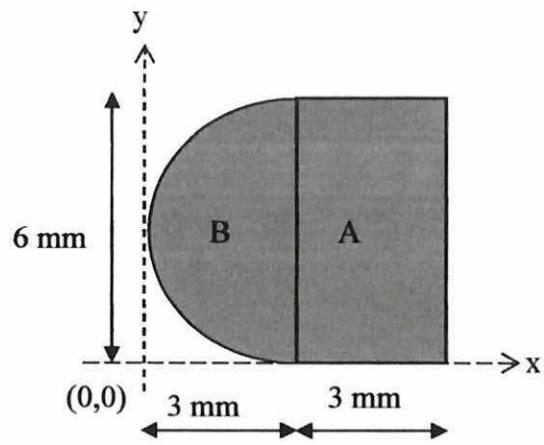

Figure Q5 (b)

END OF QUESTIONS