UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION

SEMESTER I

SESSION 2018 / 2019

COURSE NAME	:	STATICS
COURCE CODE	:	BDA 10203
PROGRAMME	:	BDD
EXAMINATION DATE	:	DECEMBER 2018/JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION :	:	PART A: ANSWER **THREE (3)** QUESTIONS **ONLY**
		PART B: ANSWER **ALL** QUESTIONS

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

TERBUKA

CONFIDENTIAL

PART A (OPTIONAL):
Answer **THREE (3)** questions **ONLY**.

Q1. (a) Evaluate each of the following to three significant figures and express each answer in SI units using an appropriate prefix.

    (i)   435 MN/23.2 mm   (2 marks)

    (ii)   (354 mg)(45 km)/0.0356 kN   (4 marks)

(b) The typical design of pin connected and roller support frame as shown in **Figure Q1 (b)**. Calculate the support reaction, free body diagram, zero force member and force in all members support frame.

(14 marks)

Q2. (a) Astronauts in the space shuttle use radar to determine the magnitudes and direction cosines of the position vectors of two satellites A and B as shown in **Figure Q2 (a)**. The vector $\mathbf{r}_A$ from the shuttle to satellite A has a magnitude of 2 km, and direction cosines $\cos \alpha = 0.768$, $\cos \beta = 0.384$, $\cos \gamma = 0.512$. The vector $\mathbf{r}_B$ from the shuttle to satellite B has a magnitude of 4 km and direction cosines $\cos \alpha = 0.743$, $\cos \beta = 0.557$, $\cos \gamma = 0.371$. Determine the distance between the satellites.

(5 marks)

(b) **Figure Q2 (b)** shows the 70 m tall tower is supported by three cables that exert forces F_{AB}, F_{AC}, and F_{AD} on it. The magnitude of each force is 2 kN. Express the total force exerted on the tower by the three cables in terms of scalar components. Determine:-

    (i)   The position vectors corresponding to the cables.

(3 marks)

    (ii)   The unit vectors corresponding to these position vector.

(4 marks)

    (iii)   The total force exerted on the tower by three cables in terms of scalar components.

(8 Marks)

2

CONFIDENTIAL

Q3. (a) The boom shown in **Figure Q3 (a)** is supported by a ball-and-socket joint at A and a guy wire at B. If the 5 kN loads lie in a plane which is parallel to the x–y plane,

   (i) Draw the free body diagram of the boom.

   (4 marks)

   (ii) Determine the x, y, z components of reaction at A and the tension in the cable at B.

   (8 marks)

   (b) **Figure Q3 (b)** shows a 50 kg paper roll has a center of mass at G and rests on the smooth blade of the paper hauler.

   (i) Draw the free-body diagram of the paper roll.

   (4 marks)

   (ii) Determine the normal reaction at A and B.

   (4 marks)

Q4. (a) Explain briefly about a zero-force member.

   (2 marks)

   (b) What are the differences between truss and frame?

   (4 marks)

   (c) The Howe bridge truss shown in **Figure Q4 (c)** is subjected to the loading shown.

   (i) Determine the force in members HD, CD, and GD, and state if the members are in tension or compression.

   (7 marks)

   (ii) Determine the force in members HI, HB, and BC, and state if the members are in tension or compression.

   (7 marks)

3

PART B (COMPULSORY):

Answer **ALL** questions.

Q5. (a) Calculate the centroid $(\bar{x}, \bar{y})$ of the uniform wire bent in the shape shown in **Figure Q5 (a)**

(10 marks)

(b) The gravity wall shown in **Figure Q5 (b)** is made of concrete. Determine the location $(\bar{x}, \bar{y})$ of the center of mass G for the wall.

(10 marks)

Q6. (a) Draw the free body diagram of the block shown in **Figure Q6 (a)** and determine the maximum angle which the adjustable incline may have with the horizontal before the block of mass, m begins to slip. The coefficient of static friction between the block and the inclined surface is μ_s.

(6 marks)

(b) Draw the free the body diagram of the block shown in **Figure Q6 (b)** and determine the range of values which the mass, m_o may have so that the 100 kg block shown in the figure will neither;

(i) start moving up the plane

(11 marks)

(ii) nor slip down the plane.

(3 marks)

The coefficient of static friction, μ_s for the contact surfaces is 0.30.

- END OF QUESTION –

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I /2018/2019	PROGRAMME	: BDD
COURSE NAME	: STATICS	COURSE CODE	: BDA10203
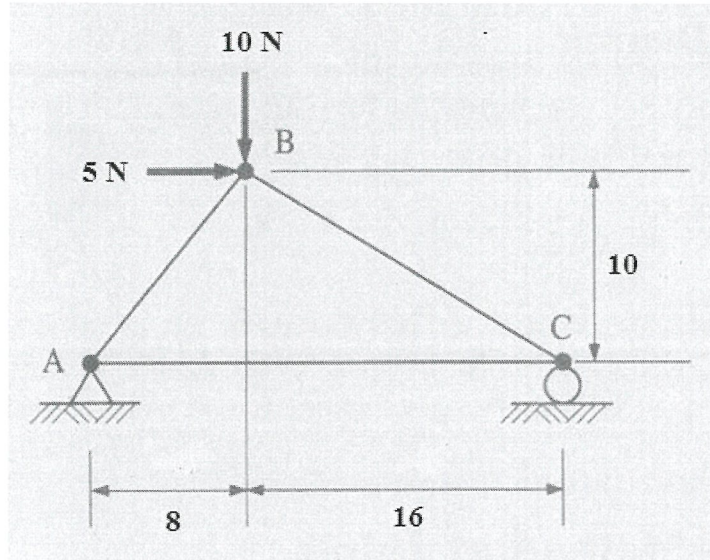
Figure Q1 (b)
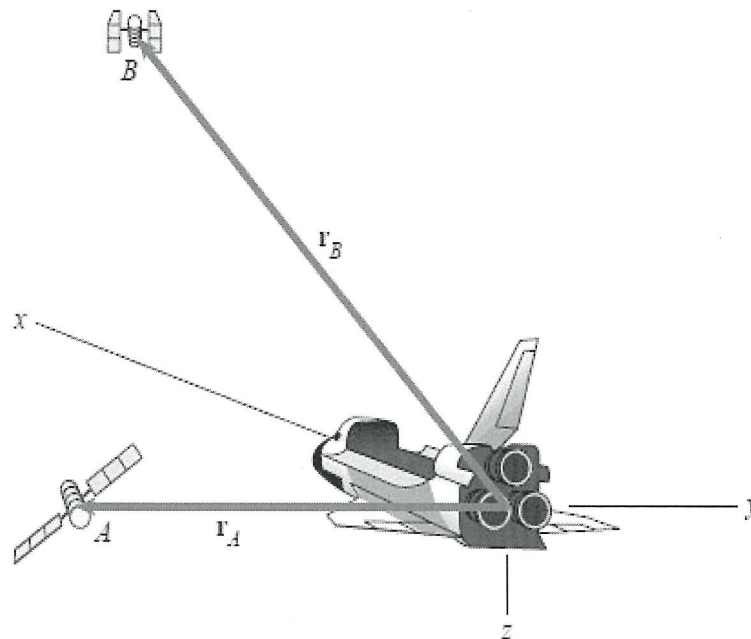
Figure Q2 (a)

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I /2018/2019	PROGRAMME	: BDD
COURSE NAME	: STATICS	COURSE CODE	: BDA10203
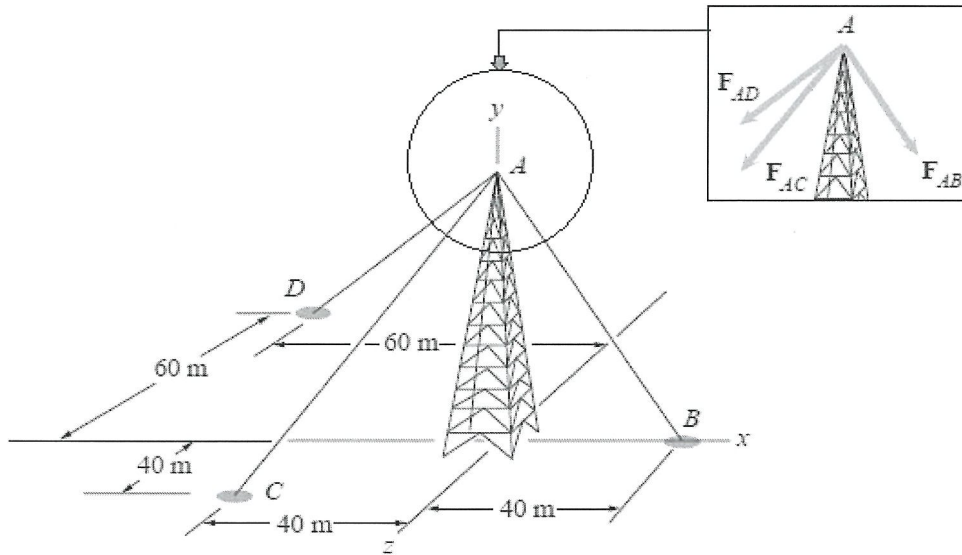
Figure Q2 (b)
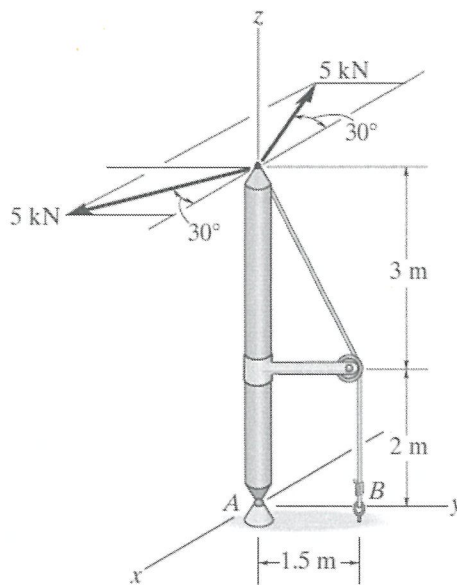
Figure Q3 (a)

6

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I /2018/2019	PROGRAMME	: BDD
COURSE NAME	: STATICS	COURSE CODE	: BDA10203
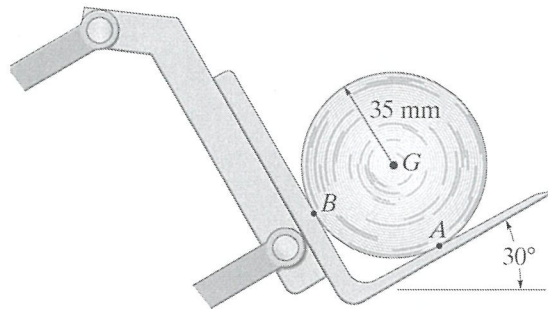
Figure Q3 (b)
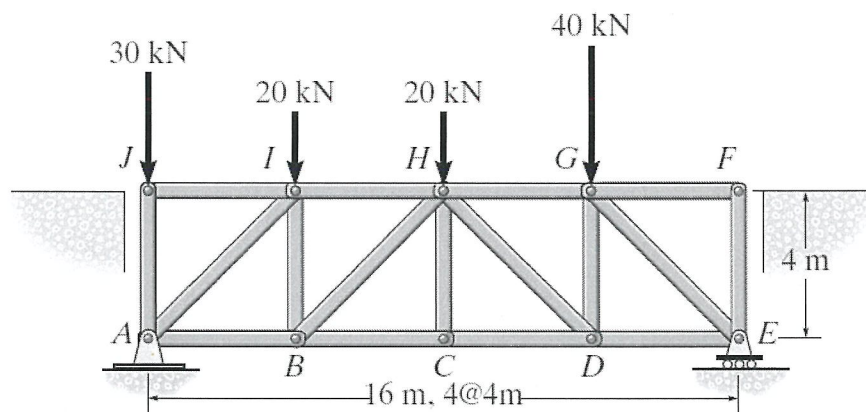
Figure Q4

7

FINAL EXAMINATION

PROGRAMME	: SEM I /2018/2019	PROGRAMME	: BDD
COURSE CODE	: STATICS	COURSE CODE	: BDA10203
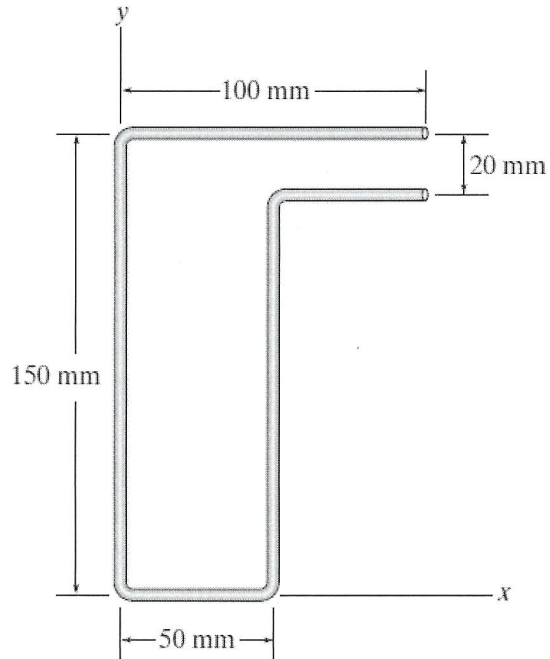
Figure Q5 (a)
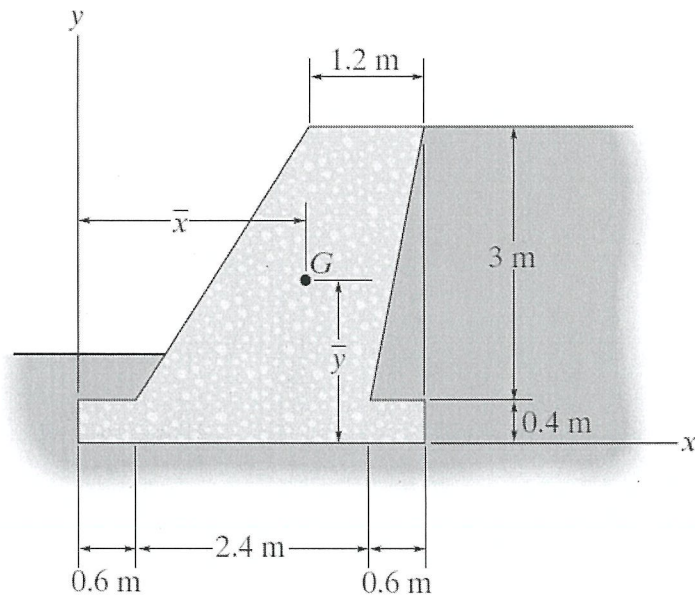
Figure Q5 (b)

FINAL EXAMINATION

PROGRAMME	: SEM I /2018/2019	PROGRAMME	: BDD
COURSE CODE	: STATICS	COURSE CODE	: BDA10203

Figure Q6(a)

Figure Q6(b)