Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME:	STATICS
COURSE CODE:	BDA 10203
PROGRAMME:	BDD
EXAMINATION DATE:	JANUARY/FEBRUARY 2021
DURATION:	3 HOURS
INSTRUCTIONS:	**PART A**: ANSWERS **THREE (3)** OUT OF **FOUR (4)** QUESTIONS **PART B**: ANSWERS **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF EIGHT (8) PAGES

PART A

Q1 **(a)** By using your own diagram, explain the First, Second and Third Newton's Law (12 marks)

(b) **Table Q1(a)** shows the parameters of two particles masses m_1 and m_2, respectively. If m_1 and m_2 are separated at a distance d,

i. calculate the force of gravity acting between them (3 marks)

ii compare the results with the weight of each particle (5 marks)

Table Q1(a)

	Student with **ODD** matric number (XD 20xxA) A=1,3,5,7,9	Student with **EVEN** matric number (XD 20xxB) B=0,2,4,6,8
m_1	8 kg	10 kg
m_2	12 kg	7 kg
d	800 mm	700 mm
G	66.73×10^{-12} m^3/ kg s^2	

Q2 **(a)** A force vector is given in terms of its components by $\mathbf{F} = \{10\mathbf{i} + 20\mathbf{j} + 20\mathbf{k}\}$ N.

i. What are the direction cosines (α, β and γ) of **F**? (4 marks)

ii Determine the components of a unit vector **u** that has the same direction as **F**. (2 marks)

(b) The car in **Figure Q2(b)(i)** and the pallet supporting it weigh 13500 N. They are supported by four cables *AB*, *AC*, *AD*, and *AE*. The locations of the attachment points on the pallet are shown in **Figure Q2(b)(ii)**. The tensions in cables *AB* and *AE* are equal. The coordinates of each point are depending on your last digit of your matrix number as listed in the **Table Q2(b)**.

Table Q2(b)

Length	The last digit of student's matrix number		
	0, 1, 2	3, 4, 5	6, 7, 8, 9
a	1.5 m	2 m	2.5 m
b	2 m	2.5 m	3 m
d	2.5 m	3 m	3.5 m
e	3 m	3.5 m	4 m

i. Write the tension in cable AB, AC, AD and AE in cartesian vector notation.
(4 marks)

ii. Determine the tensions in the cables AB, AC, AD, and AE.
(10 marks)

Q3 **(a)** i. Briefly explain the difference between truss and frame.
(2 marks)

ii. Sketch **ONE (1)** only from the following bridge truss
- Pratt Bridge Truss
- Howe Bridge Truss
- Warren (with vertical) bridge Truss

(2 marks)

(b) The truss is used to support the roof of building as shown in **Figure Q3(b).** The truss is simply pin supported at **A** and roller supported at **D**. The interior angle **BAE, CBE** and **CDE** is 53.1°. The load applies 5 kN and 12 kN at point **C** and **E** respectively.

i. Draw the free body diagram.

(3 marks)

ii. Find the reaction at the given supports.

(3 marks)

iii Determine force supported by each member of the truss

(4 marks)

iv. State whether **ALL** members are in tension or compression.

(5 marks)

Q4 The steel plate is 0.3 m thick and has a density of 7850 kg/m^3 as shown in **Figure Q4**:

(a) Prove that the integral location of center of mass **Part A** is shown.

$$\bar{X} = \frac{3}{5}[x]_0^2 \, , \bar{Y} = \frac{3\sqrt{2}}{8}\left[\sqrt{x}\right]_0^2$$

(10 marks)

(b) Determine the location of center of mass for steel bodies shown.

(6 marks)

(c) Find the reactions at the pin and roller supports.

(4 marks)

PART B

Q5 **(a)** What is the couple system? Explain an example of couple system using an appropriate sketch and its FBD.

(5 marks)

(b) A bracket for a mechanical system as illustrated in **Figure Q5(b)** is in an equilibrium condition. Determine the magnitude of the couple.

(5 marks)

(c) The combined action of the three forces on the base at O can be obtained by establishing its resultant force (R) and moment (M) as illustrated in **Figure Q5(c)**. Calculate the magnitudes of resultant force (R) and moment (M).

(10 marks)

Q6 **Figure Q6** shows a system of static friction between the surfaces of A, B, C and D. There is coefficient of friction μ_1 between wedges B-C, and coefficient of friction μ_2 between contact surfaces A-B and C-D.

(a) Propose the free body diagram of the wedges

(4 marks)

(b) Determine the lowest force P needed in order to move the wedge C to the left.

(10 marks)

(c) Determine the smallest allowable compression of the spring δ without causing wedge C to move to the left. If the P is used only 30% of force.

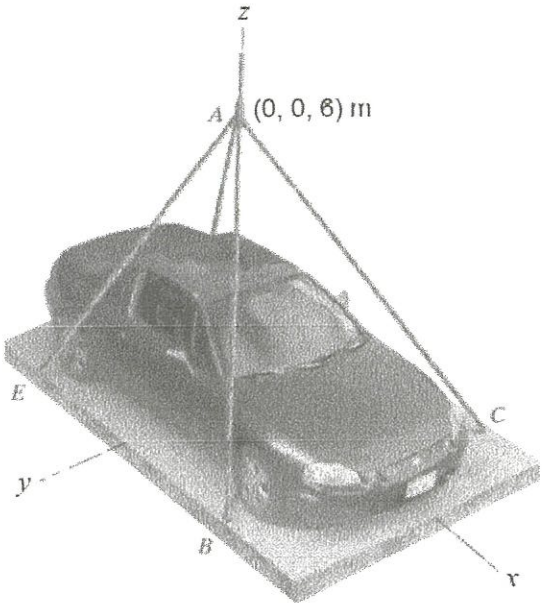
(6 marks).

Given: $\mu_1 = 0.6$, $\mu_2 = 0.4$, $\delta = 200$ mm, $\theta - 15°$, $k - 500$ N/m. Neglect the weight of the wedges.

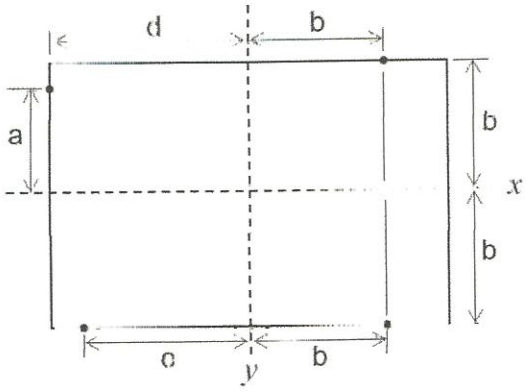
-END OF QUESTION-

FINAL EXAMINATION

SEMESTER/SESSION	**: SEMESTER 1 /2020/2021**	**PROGRAMME :**	**BDD**
COURSE	**: STATICS**	**COURSE CODE:**	**BDA 10203**



(i)



(ii)

Figure Q2(b)

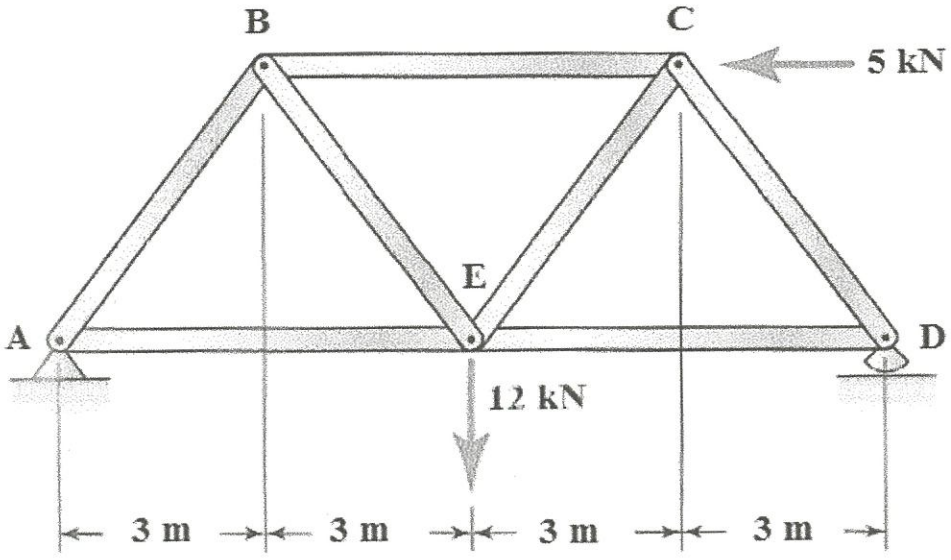


Figure Q3(b)

FINAL EXAMINATION

SEMESTER/SESSION	**: SEMESTER 1 /2020/2021**	**PROGRAMME :**	**BDD**
COURSE	**: STATICS**	**COURSE CODE:**	**BDA 10203**

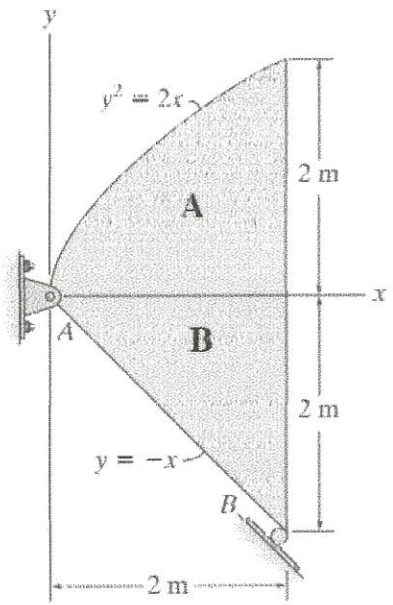


Figure Q4

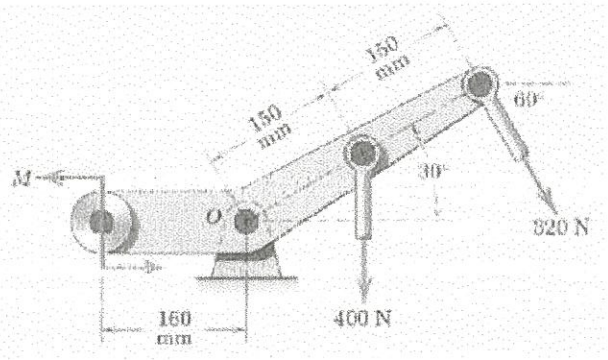


Figure 5(b)

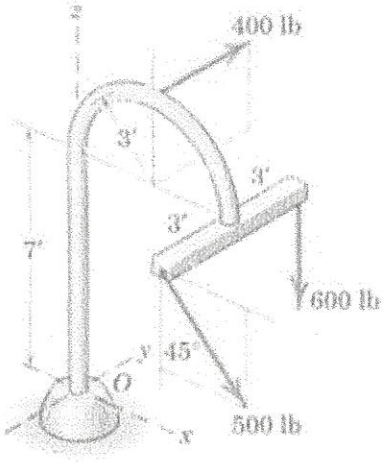


Figure 5(c)

FINAL EXAMINATION

SEMESTER/SESSION	**: SEMESTER 1 /2020/2021**	**PROGRAMME :**	**BDD**
COURSE	**: STATICS**	**COURSE CODE:**	**BDA 10203**

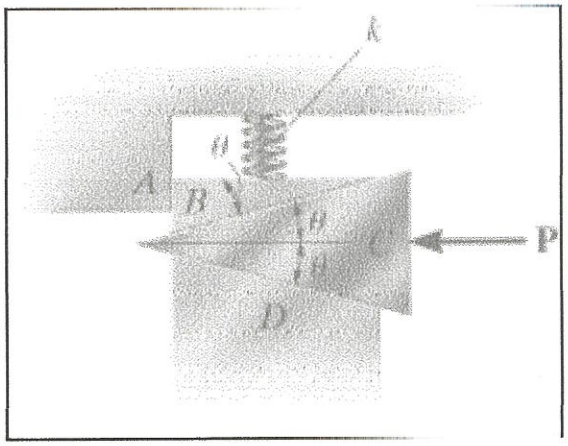


Figure Q(6)