Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	MECHANICS OF MACHINES
COURSE CODE	:	BDA 20303
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JANUARY/FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	PART A: ANSWER **ALL** QUESTION
		PART B: ANSWER **FOUR (4)** ONLY OUT OF **FIVE (5)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

PART A (COMPULSORY)

Answer **ALL** questions.

Q1 A mechanism shown in **Figure Q1(a)** has an ultimate motion of piston D. The system has a constant rotation of crank OA, **[A]** rpm. The links has the dimension as follows: OA = 28 mm, AB = 44 mm, BC = 49 mm, BD = 46 mm.

(a) By using graphical approach, draw the vector diagram to identify the velocity V_A, V_{BA}, V_C, V_{BD}, and V_D at instant when the link AO is rotated. Make sure that your vector diagram is visible and clear.

(8 marks)

(b) If the diameter of the pin at A is **[B]** mm, calculate the rubbing velocity of pin at A.

(6 marks)

(c) Determine the angular velocity of link BA and link DB.

(6 marks)

Use your last matrix number to get value of **[A]** and **[B]** as an example below:

Example: If your matrix number is AD180308; Thus, the last number is '8'

Last matrix number	**0 - 3**	**4 - 6**	**7 - 9**
Value of **[A]**	450	480	500
Value of **[B]**	3	4	5

So, value **[A]** = 500 rpm and **[B]** = 5 mm

PART B (OPTIONAL)

Answer **FOUR (4) ONLY** out of **FIVE (5)** questions.

Q2 Two parallel shafts, the axes of which are about **[A]** m apart, are to be connected by a pair of toothed wheels so that one rotates 3.5 times as fast as the other. If the diametral pitch is **[B]** per cm.

(a) Determine the number of teeth in each wheel and the exact distance between the centers of the shafts

(10 marks)

(b) If the distance between the shaft centers is to be accurately 1.? m, what would have been the velocity ratio?

(10 marks)

Use your last matrix number to get value of **[A]** and **[B]** as an example below:

Example: If your matrix number is AD180308; Thus, the last number is '8'

Last matrix number	**0 - 3**	**4 - 6**	**7 - 9**
Value of **[A]**	1.0	1.1	1.2
Value of **[B]**	4.0	4.2	4.4

So, value **[A]** = 1.2 m and **[B]** = 4.4 per cm

Q3 A compressor requiring **[A]** kW to run about **[B]** rpm. The drive is by V-belts from an electric motor running at 750 rpm. The diameter of the pulley on the compressor shaft must not be greater than 1 m, while the center distance between the pulleys is limited to 1.75 m. The belt speed should not exceed 1600 m/min. Determine the number of V-belts required to transmit the power if each belt has a cross sectional area of 375 mm^2, density 1000 kg/m^3 and an allowable tensile stress of 7.5 MPa. The groove angle of the pulley is 35°. The coefficient of friction between the belt and the pulley is 0.25.

(20 marks)

Use your last matrix number to get value of **[A]** and **[B]** as an example below:

Example: If your matrix number is AD180308; Thus, the last number is '8'

Last matrix number	**0 - 3**	**4 - 6**	**7 - 9**
Value of **[A]**	80	85	90
Value of **[B]**	180	200	250

So, value **[A]** = 90 kW and **[B]** = 250 rpm

Q4 (a) (i) In a simple word define what is balancing and describe why balancing plays an important role in a machinery system.

(2 marks)

(ii) Explain the difference between full balancing and partial balancing. List **ONE (1)** practical example for each of them to support your answer.

(2 marks)

(b) **FIQURE Q4(b)** shows a system with three weights on rotating shaft. W_1 = $40N\angle 90°$ at a 101.6 mm radius, $W_2 = 40N\angle 225°$ at 152.4 mm radius, and $W_3 = 26.7 N\angle 315°$ at 254 mm radius. The balance weight in planes 4 and 5 are placed at a 76.2 mm radius to dynamically balance the system. Determine using the graphical method:

(i) By considering the given data and diagram of **FIQURE Q4(b)**, draw the couple polygon and force polygon diagram to some suitable scale.

(8 marks)

(ii) Calculate the magnitudes of the balance weights (planes 4 and 5) in Newton (N)

(4 marks)

(iii) Identify the angles of the balance weights, measured counter clockwise from reference angle.

(4 marks)

Q5 An effort of 3 kN is required just to move a certain body up an inclined plane of an angle **[A]**°. The effort of 1 kN is required to just move the same body down the same plane. Both forces acting parallel to the plane

(a) Draw the free body diagrams for both conditions.

(4 marks)

(b) Determine the weight of the body and the coefficient of friction.

(6 marks)

(c) What would the coefficient of friction value be if the same body in above question is made to just move on the same plane with 0°of inclination. Please explain and verify your answer with calculation.

(10 marks)

Use your last matrix number to get value of **[A]** and **[B]** as an example below:

Example: If your matrix number is AD180308; Thus, the last number is '8'

Last matrix number	**0 - 3**	**4 - 6**	**7 - 9**
Value of **[A]**	15	18	20

So, value **[A]** = 20°

Q6 (a) A watch is wound up regularly at the same time every day and the main spring spindle receives 4.5 complete turns during the winding as shown in **Figure 6(a)**.

(i) Determine the velocity ratio of the train of wheels connecting the main spring spindle and the hour hand spindle

(3 marks)

(ii) Identify the velocity ratio of the train of wheels, connecting the minute hand spindle to hour hand spindle.

(3 marks)

(iii) Propose a suitable train of wheels for the latter, such that no wheel has more than 40 teeth.

(4 marks)

(b) A friction clutch is to transmit **[A]** kW at **[B]** rpm. It is to be a single plate type with both sides of the plate effective, the axial pressure being limited to 0.09 N/mm^2. If the external diameter of the friction lining is 1.4 times the internal diameter, analyze all the given parameter to determine the required dimensions of the friction lining. Assume uniform wear conditions. The coefficient of friction may be taken as 0.3

(10 marks)

Use your last matrix number to get value of **[A]** and **[B]** as an example below.

Example: If your matrix number is AD180308; Thus, the last number is '8'

Last matrix number	**0 - 3**	**4 - 6**	**7 - 9**
Value of **[A]**	8	9	10
Value of **[B]**	2600	2800	3000

So, value **[A]** = 10 kW and **[B]** = 3000 rpm

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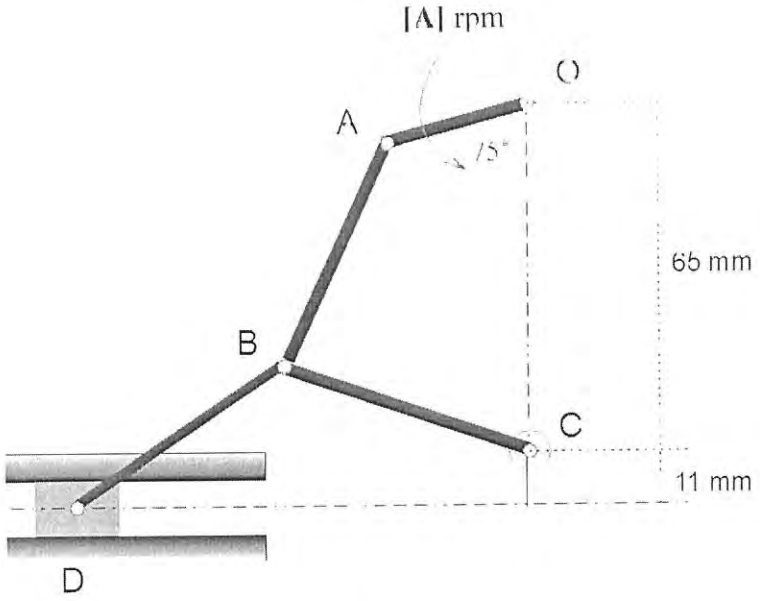

Figure Q1(a)

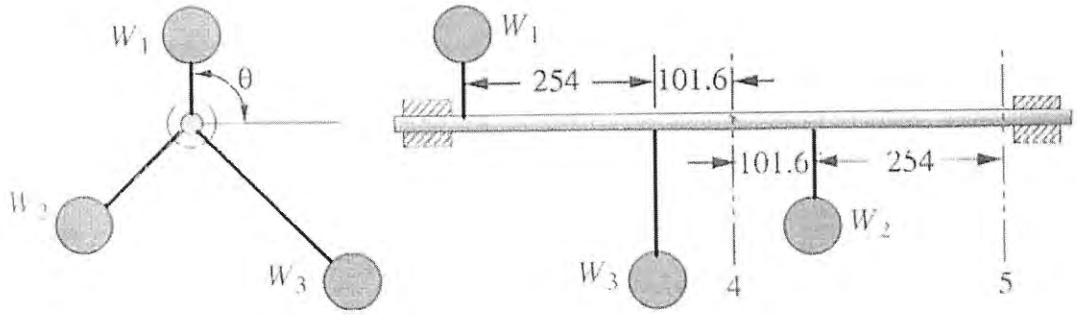

Figure Q4(b)

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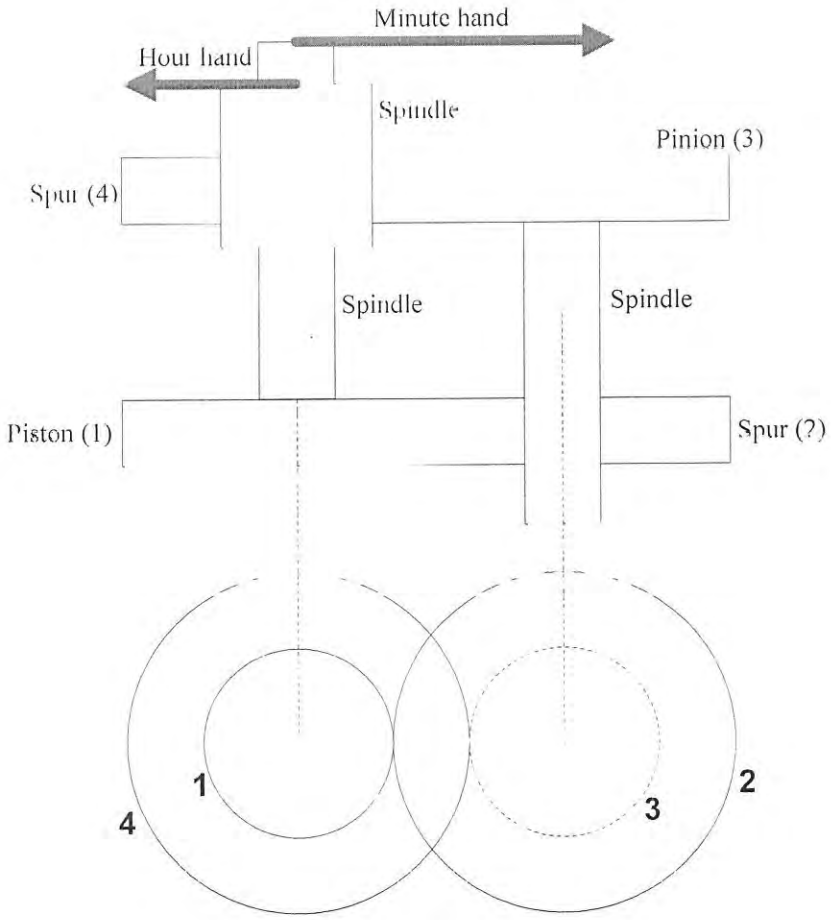

Figure Q6(a)