UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	KINEMATICS MECHANISMS
COURSE CODE	:	BDC 40303
PROGRAMME	:	4 BDD
DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS

THIS PAPER CONSIST OF **FIVE (5)** PAGES

Q1 A planetary gear train is illustrated in **FIGURE Q1**. The carrier (link 2) serves as the input to the train (1200RPM). The sun (gear 1) is the fixed gear and has 30 teeth. The planet gear (gear 3) has 35 teeth. The ring gear serves as the output from the train and has 100 teeth.

    (a) By using superposition method, propose the steps to determine the rotational velocity of all members.

(5 marks)

    (b) Considering the proposed steps, calculate all rotational velocity of all members. You have to use the planetary gear analysis table in your answer.

(15 marks)

Q2 A cam is used to lift boxes from lower conveyor to upper conveyor repeatedly. The illustration of the mechanism is shown in **FIGURE Q2**.
The follower sequence in one cycle is the following:

        Stage 1. Rise 5 cm in 1.0s
        Stage 2. Dwell for 0.3s
        Stage 3. Fall 2.5 cm in 0.9s
        Stage 4. Dwell for 0.6s
        Stage 5. Fall 2.5 cm in 0.9s

    (c) Calculate the time for a full cycle.

(1 marks)

    (b) Calculate the required rotational speed of the cam (in RPM).

(3 marks)

    (c) Determine the cam rotation in each interval.

(1 marks)

    (d) Plot graphically the **falling** displacement diagram of the cam if it follows harmonic function. Use 6 data intervals to plot.

(5 marks)

Q3 For the kinematic diagram shown in **FIGURE Q3**, the angular velocity of link 2 is 20 rad/s counter-clockwise.

    (a) Analyse the system by using an analytical approach to determine the angular velocity of link 4, the sliding (relative) velocity of link 3 on link 4.

(5 marks)

    (b) Analyse the system by using an analytical approach to to determine the angular acceleration of link 4 and the sliding (relative) acceleration of link 3 on link 4.

(15 marks)

    (c) Verify your analytical methods in (a) and (b) by using graphical methods.

(15 marks)

Q4   **Answer option A or option B only**

Option A:

A simplified mechanism is shown in **FIGURE Q4.**

(a)   By using graphical approach (**the approach is instantaneous center of velocity**) or relative velocity), find the velocity of point B, C and D

(5 marks)

(b)   By using graphical approach, evaluate the graph to determine the acceleration of point B, C and D

(15 marks)

(c)   Analyse the system by using an analytical vector approach to find the acceleration of point D.

(15 marks)

Option B:

A simplified mechanism is shown in **FIGURE Q4.** For the option B, the input motion at point A is 560 RPM (**clock wise rotation**)

(a)   By using graphical approach (**the approach is relative velocity**), find the velocity of point B, C and D

(5 marks)

(b)   By using graphical approach, evaluate the graph to determine the acceleration of point B, C and D

(15 marks)

(c)   Analyse the system by using an analytical vector approach to find the acceleration of point D.

(15 marks)

---- END OF QUESTIONS ---

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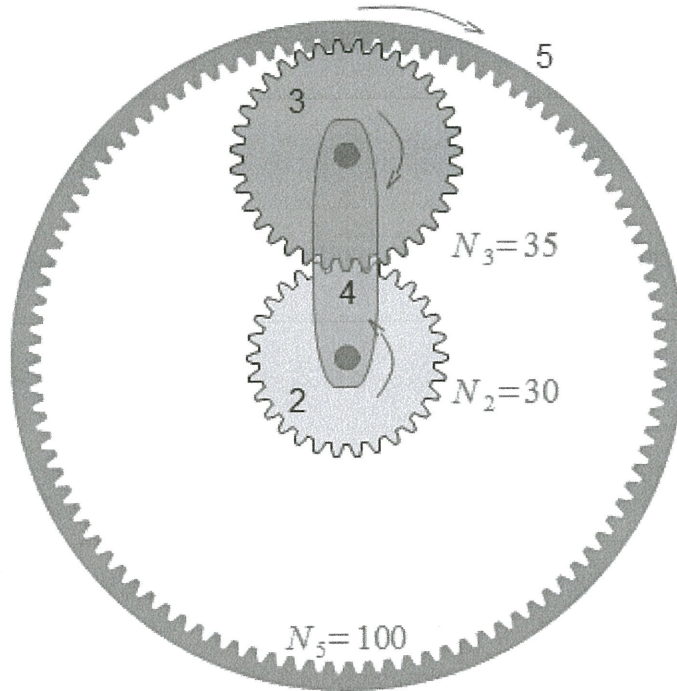COURSE : KINEMATICS MECHANISMS   COURSE CODE : BDC40303
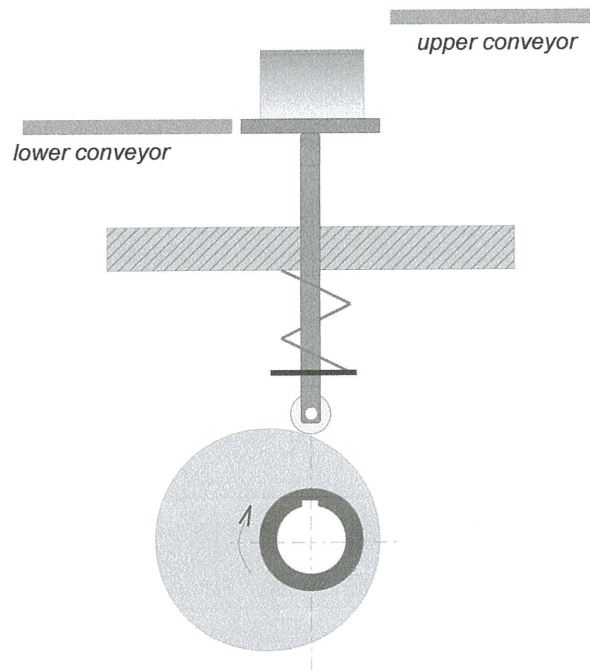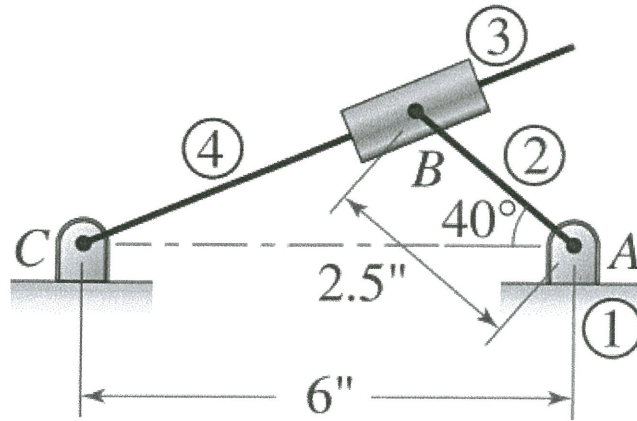

$N_3 = 35$

$N_2 = 30$

$N_5 = 100$

FIGURE Q1

upper conveyor

lower conveyor

FIGURE Q2

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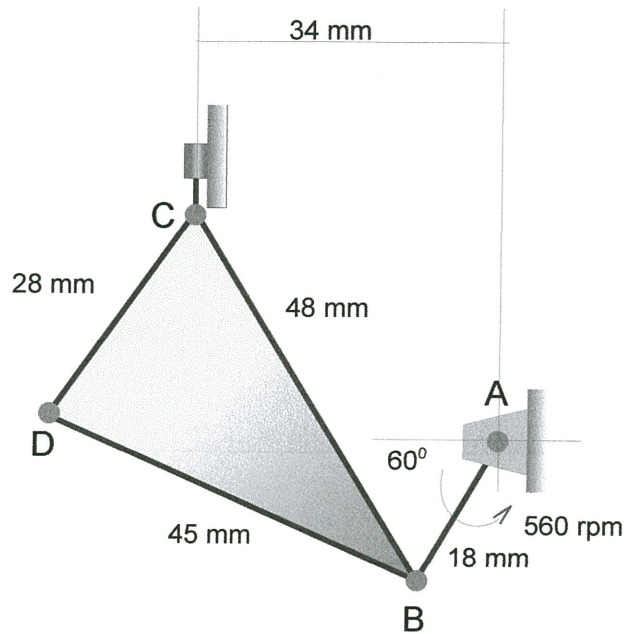

(use the original dimensions in inch)

FIGURE Q3

FIGURE Q4