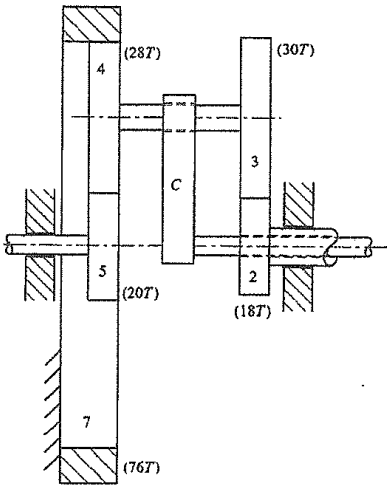
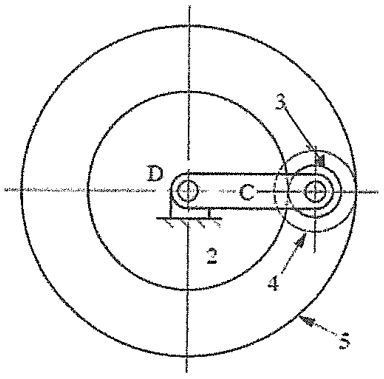
8. **(12 Marks)** Assume that gear 5 in the figure is driven at a speed of 200 rpm in the CCW direction viewed from the left end. Gear 4 meshes with a fixed ring gear and with gear 5 as shown. Find the magnitude and direction of the angular velocity of gear 2.



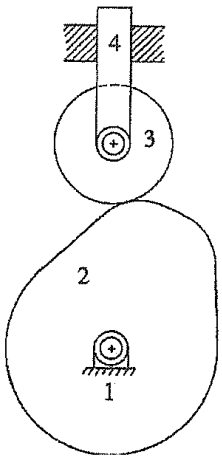
End of Questions.
Best wishes.

7. **(16 Marks)** In the gear train shown, gears 3 and 4 are integral (compound gears). Gear 3 meshes with gear 2, and gear 4 meshes with gear 5. If gear 2 is fixed and $\omega_5 = 100$ rpm CCW, determine the angular velocity of the carrier.

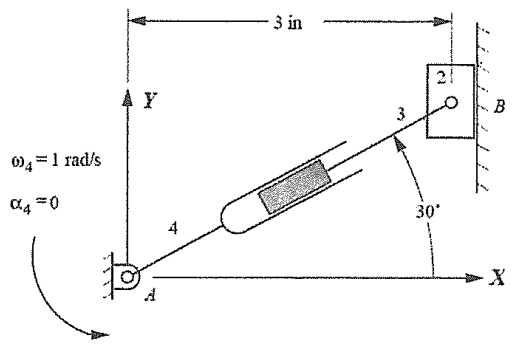


$N_2 = 60T$
$N_3 = 16T$
$N_4 = 24T$
$N_5 = 100T$

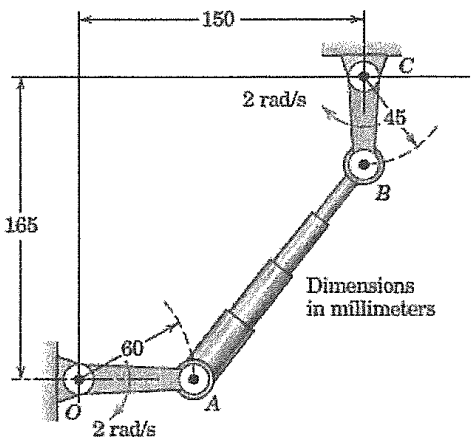
6. a. **(6 Marks)** For the cam mechanism shown, find the pressure angle at the position shown.
   b. **(12 Marks)** Draw the displacement schedule for a follower that rises through a total displacement of 60 mm with cycloidal motion in 120° of cam rotation. The follower then dwells for 40° and falls 30 mm with constant acceleration in 80° followed by a fall of 30 mm with constant deceleration in 80°. The follower then dwells for 40° before repeating the cycle.



5. **(20 Marks)** In the mechanism shown, $\omega_4 = 1$ rad/s CW (constant). Using the analytical method, determine the velocity and acceleration of point B.

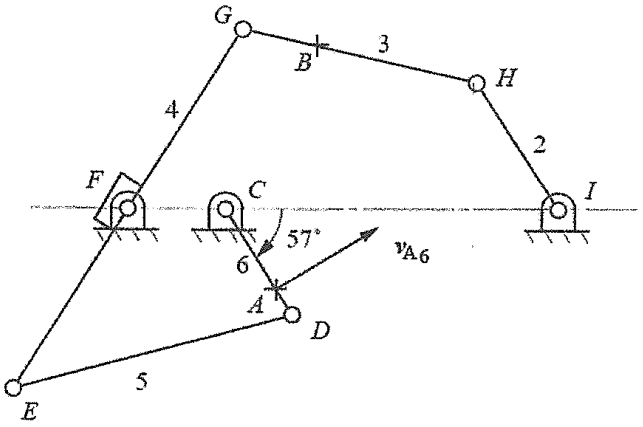


4. **(16 Marks)** for the mechanism shown, write the appropriate vector equations, solve them using vector polygon, and determine the angular velocity of the telescoping link AB for the position shown where the driving links have the angular velocities indicated. Use velocity scale 1 cm:20 mm/s.



3. **(16 Marks)** If $v_A = 10$ in/s, determine the velocity vector (magnitude and direction) for point B on link 3 using an instant center method.

$CD = 0.8"$
$CA = 0.6"$
$ED = 1.85"$
$EF = FG = 1.35"$
$GH = 1.5"$
$HI = 0.95"$
$CI = 2.1"$
$CF = 0.65"$

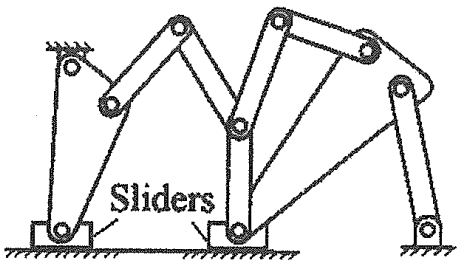


Kafrelsheikh University
Faculty of Engineering
Dept. of Mech. Engineering
Year: second Year
Subject: Theory of Machines

1st Semester
Final Examination
Date: Jan. 17th, 2017
Time allowed: 3 hours
Full Mark: 100

1. No. of pages: 8
2. No. of questions: 8

1. **(10 Marks)** For the linkage shown in the figures, determine the number of degrees of freedom of the mechanisms.



2. **(10 Marks)** Assume that you have a set of the following lengths: 20 mm, 30 mm, 45 mm, 56 mm, and 73 mm. Design a four-bar linkage that can be driven with a continuous-rotation electric motor. Justify your answer with appropriate equations, and make a freehand sketch of the resulting linkage. Label the crank, frame, coupler, and rocker (follower).