UNIVERSIDAD CARLOS III DE MADRID

Bachelor in Mechanical Engineering

Machine Theory

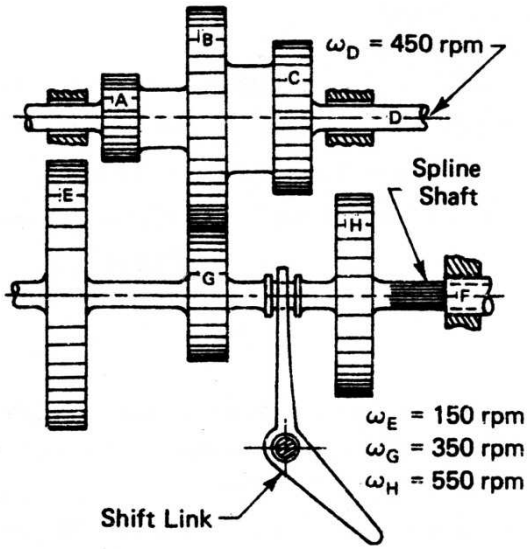
1ST PARTIAL EXAM

October, 27th 2011

SURNAME:_____

NAME:_____ **NIA:**_____

The figure shows a three-speed shiftable transmission. The cluster of links **E**, **G** and **H** are able to slide left and right to engage and disengage the three gear sets by using the shift link. Design the three reverted stages (**A-E**, **B-G** and **C-H**) to give output speeds at shaft **F** of 150, 350, and 550 rpm for an input speed of 450rmp to shaft **D.** Gear teeth are to be kept within the limits of from 10 to 80 teeth. **(2.5p)**



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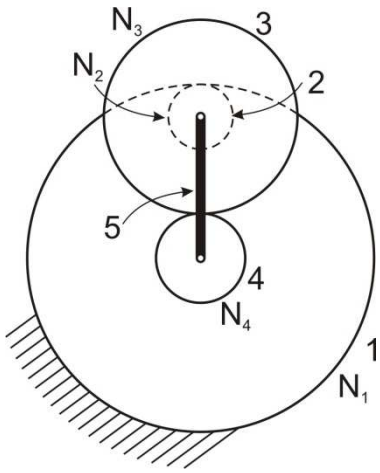
For the planetary gear train of the figure determine the ratio ω_4/ω_5, either by the tabular method or by the formula method. (Notice that the gears 2 and 3 are rigidly linked).**(2.5p)**



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EXERCISE 3: CAM DESIGN (5p)

Behavior of a planar radial cam mechanism is described in SVAJ diagrams shown in Figure 1. These diagrams represent a simple harmonic motion for a single dwell application. Answer the following questions:

1. Name the different stages of the motion of the follower and the piecewise function boundary conditions regarding to Fig.1 (β,s,v, a and j)(0.5p)

2. According to the fundamental law of Cams, it is a good cam design? Why? (0.75p)

3. Assuming a zero eccentricity rolling follower of 5 mm radius and a **base radius** of the cam equal to 20 mm, sketch the cam surface profile in the sheet below.(2p)

Note: Divide the cam in 30º sectors.

4. Indicate the most relevant components of the sketch you draw in item 3.(0.25p)

5. According to diagrams in Fig.1, approximately, where will be located the maximum and the minimum pressure angle? (0.5p)

6. Using equation below, calculate both, the maximum and the minimum pressure angles. Are these values acceptable? Why? (0.75p)

$$\emptyset = \tan^{-1}\left\{\frac{v-\epsilon}{s+\sqrt{R_p^2-\epsilon^2}}\right\}\ [rad]$$

7. In case of need, what measures do you propose to reduce the pressure angle? Why? (0.25p)

Extra question: According to measures you gave in item 7, calculate the value/s of this/these parameter/s to obtain an appropriated pressure angle.

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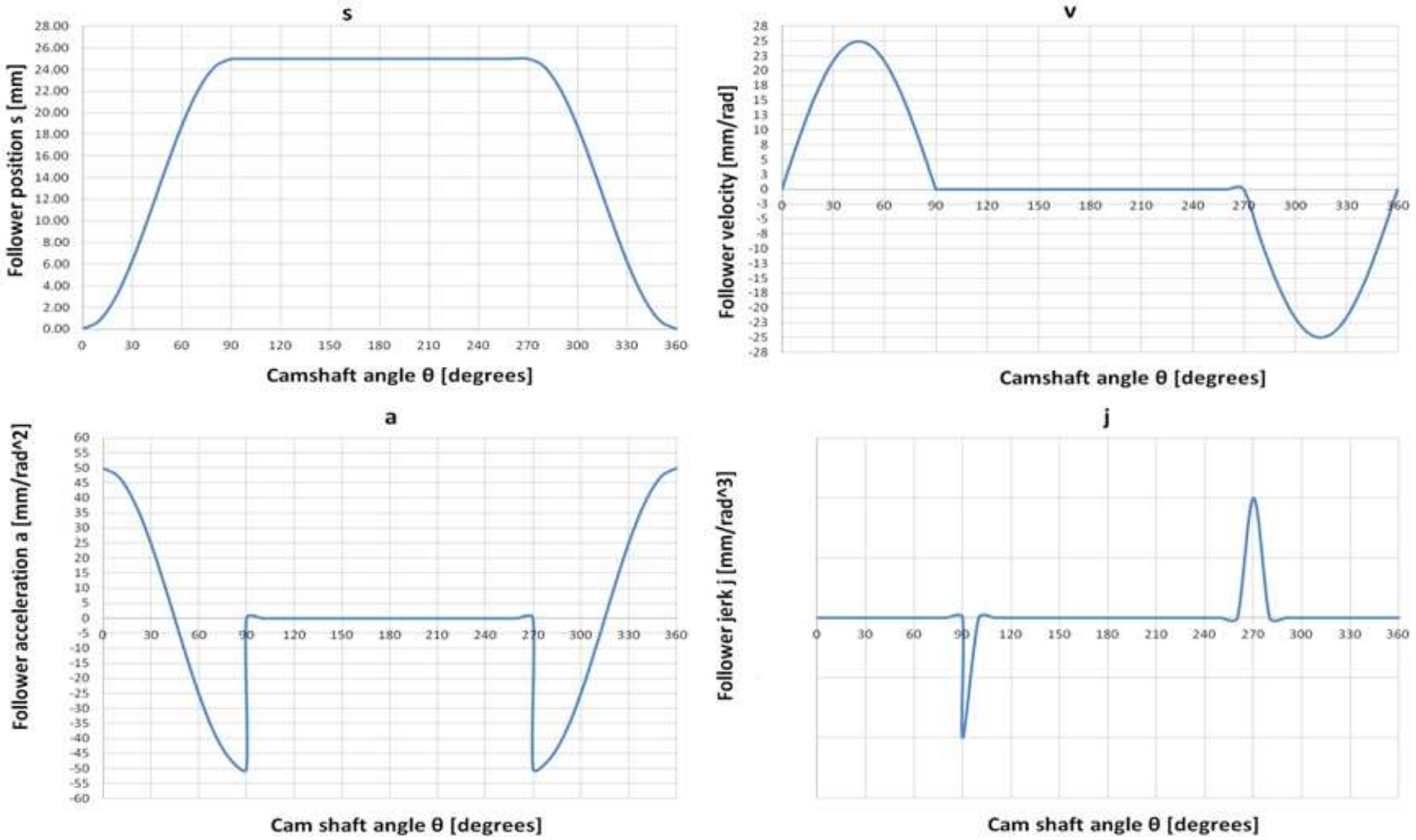

Figure 1. SVAJ diagrams of the Cam mechanism

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