

[4]

- b) Derive an expression for the ratio of driving tensions in the rope drive, assuming that the angle of the groove of the pulley to be  $2\beta$ .

8. Write short notes on following : (any three)

- a) Creep in belt
- b) Gruebler's and Kutzbach's criterion
- c) Law of gearing
- d) Types of cam and followers

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Total No. of Questions : 8]

[Total No. of Printed Pages : 4

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**AU/ME-222**

**B.E., III Semester**

Examination, December 2016

**Choice Based Credit System (CBCS)**

**Theory of Machines and Mechanisms**

*Time : Three Hours*

*Maximum Marks : 60*

- Note:** i) Attempt any five questions out of eight.  
ii) All questions carry equal marks.  
iii) Draw neat diagrams in support of your answer.

1. a) Differentiate between :  
i) a linkage and a mechanism  
ii) a mechanism and a structure  
b) A fork joint connects two links as shown in Figure 1. What is the number of DOF of this system? Prove.

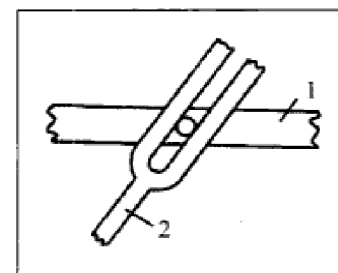


Figure 1

[2]

2. a) Prove Kennedy's theorem that three instantaneous centers shared by three bodies in relative motion to one another all lie on the same straight line.
- b) In Figure 2, an inverted slider-crank mechanism is shown. Answer the following :

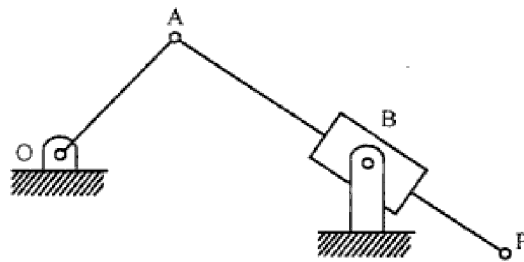


Figure 2

- i) Write a loop-closure equation for this mechanism.
  - ii) If the input is the crank angle, what are the unknowns?
  - iii) Solve the equation for the unknowns.
  - iv) Express the position of point P in terms of the input angle.
3. a) State the classification of Gears. Prove that the transmission ratio of two involute gears does not depend on the center distance between them.
  - b) Spur gears with a module  $m = 4\text{mm}$  transmit motion between two shafts with center distance  $C = 136\text{mm}$ . For the given transmission ratio 3:1 find the number of teeth for each gear.

[3]

4. a) Define radius of curvature. For a given cam, will the choice of the type of follower (knife-edge, flat-faced, roller) affect the displacement diagram.
  - b) Take a function  $x = r(\alpha - \sin\alpha)$  describing the cycloidal cam, and construct a displacement diagram with rise from 0 to  $\pi/2$ , dwell from  $\pi/2$  to  $\pi$ , and return from  $\pi$  to  $2\pi$ . Take that the lift  $L = 1\text{cm}$ . Find the maximum accelerations.
5. a) Discuss stability of two and four wheel vehicles on the basis of gyroscope.
  - b) Define gyroscopic couple. Explain gyroscopic effect on naval ships.
6. a) Define the following terms :
    - i) Crank
    - ii) Rocker
    - iii) Crank-rocker mechanism
    - iv) Double-crank mechanism
    - v) Double-rocker mechanism
  - b) A flat belt is required to transmit 40 kW from a pulley of 1.5 m effective diameter running at speed of 250 rpm. The angle of contact is spread over  $11/24$  of the circumference. Coefficient of friction for the surface is 0.3. Determine the maximum tension in the belt.
7. a) Distinguish between flat belt and V belt on the basis of power transmitted, space, grip and application.