



KERALA AGRICULTURAL UNIVERSITY
B.Tech. (Food Engg.) 2017 Admission
III Semester Final Examination-January 2019

Meen.2104

Kinematics of Machinery (2+1)

Marks: 50
Time: 2 hours

I Answer the following. (10x1=10)

- 1 What is the difference between ideal mechanical advantage and actual mechanical advantage?
- 2 State the law of gearing.
- 3 State Grubler's criteria.
- 4 Define slip and its effects on the speed ratio in a belt drive system.

Choose the correct answer

- 5 A kinematic chain known as a mechanism when
 - a All the links are fixed
 - b One link is fixed
 - c Two links are fixed
 - d Non of links is fixed
- 6 In a four bar mechanism, if the lengths of shortest, longest and the other two links are denoted by s , l , p and q , then it would result in Grashof's linkage provided that
 - a $l + p < s + q$
 - b $l + s < p + q$
 - c $l + p = s + q$
 - d $l + s = p + q$
- 7 The radius of friction circle for a shaft of radius r rotating inside a bearing is, where ϕ = friction angle
 - a $r \sin \phi$
 - b $r \cos \phi$
 - c $r \tan \phi$
 - d $r \cot \phi$
- 8 The maximization criteria for power transmission by a belt drive can be expressed as $T = \text{Maximum tension}$, $T_c = \text{Centrifugal tension}$
 - a $T = 4T_c$
 - b $T = 3T_c$
 - c $T = 2T_c$
 - d $T = T_c$
- 9 For self locking of brakes, the force P at point C will be (Figure 1)

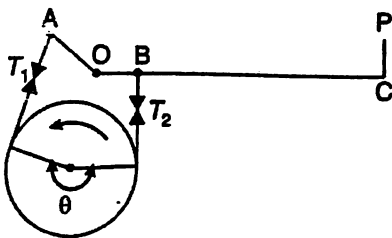


Figure 1

- a Zero
 - b Acts in upward direction
 - c Acts in downward direction
- 10 The sensitiveness of a governor is given by
 - a $\frac{\omega_{mean}}{(\omega_2 - \omega_1)}$
 - b $\frac{(\omega_2 - \omega_1)}{\omega_{mean}}$
 - c $\frac{(\omega_2 - \omega_1)}{2\omega_{mean}}$
 - d $\frac{\omega_{mean}}{2(\omega_2 - \omega_1)}$

II Write Short notes on ANY FIVE of the following

(5x2=10)

- 1 Functions of a flywheel and a governor.
- 2 Gyroscopic couple.
- 3 If p_c represents circular pitch and p_d represents diametral pitch, show that $p_c p_d = \pi$
- 4 Explain the effects of slip on power transmission in a belt drive.
- 5 Calculate the ratio of the height of a Porter governor (when the length of arms and links are equal) to the height of a Watt's governor.
- 6 Define pressure angle for a gear.
- 7 Define friction. Give some example of mechanical systems where friction necessary for its proper functioning

III Answer ANY FIVE of the following

(5x4=20)

- 1 Check the mobility criteria for the following linkages shown in figure 2 below.

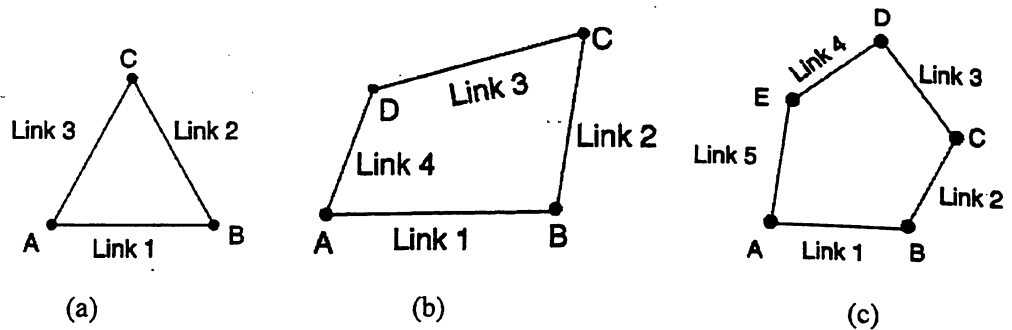


Figure 2.

- 2 Differences between a flywheel and a governor.
- 3 List all inversions of four bar mechanism. Explain clearly with neat sketches any two inversions.
- 4 Working principles of a differential band brake.
- 5 Draw the displacement, velocity and acceleration diagrams when the follower moves with simple harmonic motion. Obtain the expressions for maximum velocity and acceleration of the follower on outstroke and return stroke.
- 6 Define speed ratio and train value for a simple gear train. Derive the expressions for them.
- 7 Draw and explain the cross belt drive system and write its advantages and disadvantages. Derive the expression for the minimum length of belt in terms of diameters of pulleys and their center distance.

IV Answer ANY ONE of the following

(1x10=10)

- 1 For the four bar mechanism, shown in figure 3, the crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s², both clockwise. Draw velocity and acceleration diagrams and determine the angular velocities and angular accelerations of P_2B , and AB and the velocity and acceleration of the joint B .

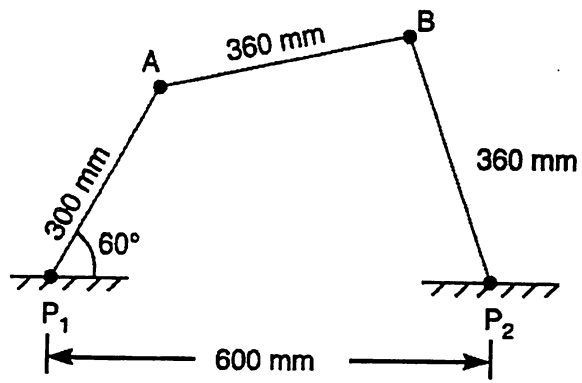


Figure 3

- 2 A Porter governor has all four arms 250 mm long. The upper arms are attached on the axis of rotation and the lower arms are attached to the sleeve at a distance of 30 mm from the axis of rotation. The mass of each ball is 5 Kg and the sleeve has a mass of 50 Kg. The extreme radii of rotation are 150 mm and 200 mm. Determine the range of speed of the governor.
