

**B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING) / BTMEVI**

Term-End Examination

December, 2019

00633

BME-020 : KINEMATICS & DYNAMICS OF MECHANISMS

Time : 3 hours

Maximum Marks : 70

Note : Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted. Assume missing data suitably, if any. Standard symbols and notations have their usual meaning.

1. A four-bar chain is represented by a quadrilateral MNOP in which MP is fixed and is 0.6 m long. The crank MN = 0.3 m long, rotates in a clockwise direction at 10 rad/sec and an angular acceleration of 30 rad/sec². The crank drives the link OP (= 0.36 m) by means of the connecting link NO (0.36 m). Draw the velocity and acceleration diagrams. Determine
 - (i) angular velocities and angular accelerations of OP and NO; and
 - (ii) the absolute velocity and acceleration of point O.

14

2. In a spring loaded Hartnell type of governor, the mass of each ball is 4 kg and the lift of the sleeve is 50 mm. The governor begins to float at 240 rpm, when the radius of the ball path is 110 mm. The mean working speed of the governor is 20 times the range of the speed when the friction is neglected. The length of the ball and the roller arms of the bell-crank lever are 120 mm and 100 mm respectively. The pivot centre and the axis of the governor are 140 mm apart. Determine the initial compression of the spring taking into account the obliquity of arms. If the friction is equivalent to a force of 20 N at the sleeve, find the total alternation in speed before the sleeve begins to move from the mid-position.

14

3. An open belt running over two pulleys 1.5 m and 1.0 m diameters connects two parallel shafts 4.80 m apart. The initial tension in the belt when stationary is 3000 N. If the smaller pulley is rotating at 600 rpm and coefficient of friction between the belt and pulley is 0.3, determine the power transmitted taking centrifugal action into account. The mass of the belt is given as 0.6703 kg/m length.

14

4. Two mating involute spur gears of 20° pressure angle have a gear ratio of 2. The number of teeth on the pinion is 20 and its speed is 250 rpm. The module pitch of the teeth is 12 mm. If the

addendum on each wheel is such that the path of approach and the path of recess on each side are half the maximum possible length, find (Assume pinion to be driver) :

- (i) the addendum for pinion and gear wheel;
- (ii) the length of the arc of contact; and
- (iii) the maximum velocity of sliding during approach and recess.

14

5. A shaft carries four rotating masses A, B, C and D which are completely balanced. The masses B, C and D are 50 kg, 80 kg and 70 kg respectively. The masses C and D make angles of 90° and 195° respectively with mass B in the same sense. The masses A, B, C and D are concentrated at radius 75 mm, 100 mm, 50 mm and 90 mm respectively. The plane of rotation of masses B and C are 250 mm apart. Determine

- (i) the mass A and its angular position, and
- (ii) the position of planes.

14

6. Draw the profile of a cam operating a knife-edge follower (when the axis of the follower passes through the axis of cam shaft) from the following data :

- (a) Follower to move outward through 30 mm with simple harmonic motion during 120° of cam rotation.
- (b) Follower to dwell for the next 60° .

- (c) Follower to return to its original position with uniform velocity during 90° of cam rotation.
- (d) Follower to dwell for the rest of the cam rotation.

The least radius of the cam is 20 mm and the cam rotates at 240 rpm.

Determine :

- (i) maximum velocity and maximum acceleration of the follower during out stroke, and
- (ii) maximum velocity and maximum acceleration of the follower during return stroke.

14

7. Write short notes on any **two** of the following :

7+7=14

- (a) Epicyclic gear train
 - (b) Kinematic pairs and their degree of freedom
 - (c) Function of flywheel
-