

Enrollment No: _____

Exam Seat No: _____

C.U.SHAH UNIVERSITY

Summer Examination-2016

Subject Name: Kinematics and Dynamics of Machines

Subject Code: 4TE03KDM1

Branch: B.Tech (Auto)

Semester: 3

Date: 26/04/2016

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1

Attempt the following questions:

(14)

- a) A ball and a socket joint forms a
(a) turning pair (b) rolling pair (c) sliding pair (d) spherical pair
- b) In a kinematic chain, a quaternary joint is equivalent to
(a) one binary joint (b) two binary joints
(c) three binary joints (d) four binary joints
- c) The total number of instantaneous centres for a mechanism consisting of n links are
(a) $\frac{n}{2}$ (b) n
(c) $\frac{n-1}{2}$ (d) $\frac{n(n-1)}{2}$
- d) The component of the acceleration, parallel to the velocity of the particle, at the given instant is called
(a) radial component (b) tangential component
(c) coriolis component (d) none of these
- e) Which of the following mechanism is used to enlarge or reduce the size of a drawing?
(a) Grasshopper mechanism (b) Watt mechanism
(c) Pantograph (d) none of these
- f) Due to slip of the belt, the velocity ratio of the belt drive
(a) decreases (b) increases (c) does not change (d) none of these
- g) When the belt is stationary, it is subjected to some tension, known as initial tension. The value of this tension is equal to the
(a) tension in the tight side of the belt
(b) tension in the slack side of the belt
(c) sum of the tensions in the tight side and slack side of the belt
(d) average tension of the tight side and slack side of the belt
- h) An imaginary circle which by pure rolling action, gives the same motion as the actual gear, is called
(a) addendum circle (b) dedendum circle (c) pitch circle (d) clearance circle



- i) Law of gearing is satisfied if
 (a) two surfaces slide smoothly
 (b) common normal at the point of contact passes through the pitch point on the line joining the centres of rotation
 (c) number of teeth = P.C.D. / module
 (d) addendum is greater than dedendum
- j) The angle between the direction of the follower motion and a normal to the pitch curve is called
 (a) pitch angle (b) prime angle (c) base angle (d) pressure angle
- k) A radial follower is one
 (a) that reciprocates in the guides (b) that oscillates
 (c) in which the follower translates along an axis passing through the cam centre of rotation.
 (d) none of the above
- l) The engine of an aeroplane rotates in clockwise direction when seen from the tail end and the aeroplane takes a turn to the left. The effect of the gyroscopic couple on the aeroplane will be
 (a) to raise the nose and dip the tail (b) to dip the nose and raise the tail
 (c) to raise the nose and tail (d) to dip the nose and tail
- m) Longitudinal vibrations are said to occur when the particles of a body moves
 (a) perpendicular to its axis (b) parallel to its axis
 (c) in a circle about its axis (d) none of the these
- n) The partial balancing means
 (a) balancing partially the revolving masses
 (b) balancing partially the reciprocating masses
 (c) best balancing of engines
 (d) all of the above

Attempt any four questions from Q-2 to Q-8

Q-2

Attempt all questions

- (a) State & explain Grashof's law with suitable diagram. (3)
- (b) Enlist various inversions of Simple slider crank chain & explain Crank and slotted lever quick return motion mechanism with neat sketch. (4)
- (c) In the mechanism shown in Figure.1, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s. The dimensions of various links are AB = 3 m inclined at 45° with the vertical and BC = 1.5 m inclined at 45° with the horizontal. Determine: 1. The magnitude of vertical and horizontal component of the acceleration of the point B, and 2. The angular acceleration of the links AB and BC. (7)

Q-3

Attempt all questions

- (a) Distinguish between Lower pair and higher pair. (3)
- (b) Describe with a neat sketch the principle and working of pantograph. (4)
- (c) Locate all the instantaneous centres of the slider crank mechanism as shown in Figure.2. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: 1. (7)



Velocity of the slider A, and 2. Angular velocity of the connecting rod AB.

Q-4

Attempt all questions

- (a) Define contact ratio and derive an equation for length of path of contact for involute gears. (7)
- (b) A cam is to be designed for a knife edge follower with the following data: 1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2. Dwell for the next 30° . 3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion. 4. Dwell during the remaining 180° . Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m. (7)

Q-5

Attempt all questions

- (a) Define and explain with neat sketch Base circle, Prime circle, Pressure angle, Pitch curve and Pitch point related to cam and follower. (7)
- (b) The speed ratio of the reverted gear train, as shown in Figure.3, is to be 12. The module pitch of gears A and B is 3.125 mm and of gears C and D is 2.5 mm. Calculate the suitable numbers of teeth for the gears. No gear is to have less than 24 teeth. (7)

Q-6

Attempt all questions

- (a) Differentiate between belt drive and gear drive. (3)
- (b) Explain centrifugal tension and derive an equation for the maximum power transmission in belt drive. (4)
- (c) Define natural frequency of vibration and obtain equation of natural frequency for spring mass system. (7)

Q-7

Attempt all questions

- (a) Explain the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn. (7)
- (b) A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. (7)

Q-8

Attempt all questions

- (a) Differentiate between static and dynamic balancing. (7)
- (b) The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.60 m. Its speed is 2000 r.p.m. The ship pitches 6° above and 6° below the horizontal position. A complete oscillation takes 30 seconds and the motion is simple harmonic. Determine the following: 1. Maximum gyroscopic couple, 2. Maximum angular acceleration of the ship during pitching, and 3. The direction in which the bow will tend to turn when rising, if the rotation of the rotor is clockwise when looking from the left. (7)



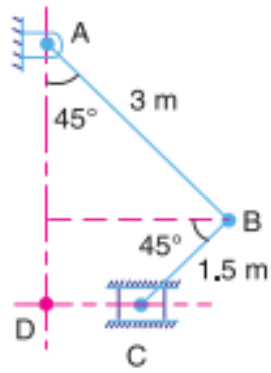


Figure.1 Q.2 (c)

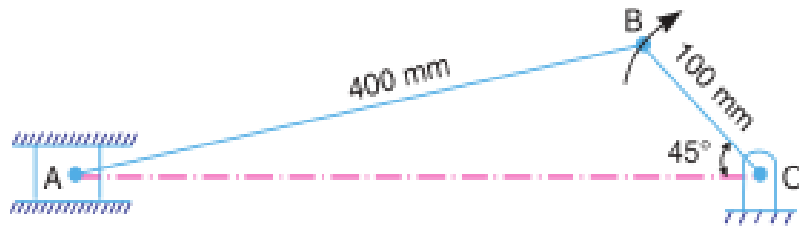


Figure.2 Q.3 (c)

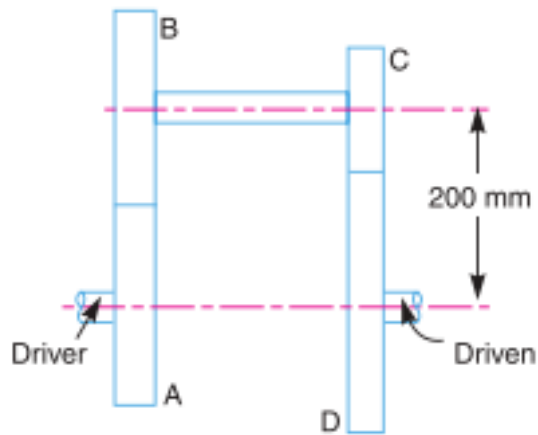


Figure.3 Q.5 (b)

