Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Winter Examination-2020

Subject Name: Kinematics of Machines

Subject Code: 4TE03KOM1 Branch: B.Tech (Mechanical)

Semester: 3 Date: 10/03/2021 Time: 11:00 To 02:00 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 Which of the following is a higher pair?
a. Turning pair b. Screw pair
c. Belt and pulley d. None of the above

b A rigid body possesses_____degrees of freedom.
a. One b. Two c. Four d. Six

c Which of the following is an inversion of Single slider crank chain?
a. Beam engine b. Elliptical trammel
c. Oldham's coupling d. Rotary engine

d According to Aronhold Kennedy's theorem, if three bodies move relative to each other, their instantaneous centres will lie on a _____.
a. straight line b.parabolic curve c. ellipse d. circle

e When a slider moves on a fixed link having curved surface, their instantaneous centre lies
(a) on their point of contact (b) at the centre of curvature
(c) at the centre of circle (d) at the pin joint

f The component of the acceleration, parallel to the velocity of the particle, at the given instant is called
(a) tangential component (b) radial component
(c) coriolis component (d) none of these

g The frictional torque transmitted by a cone clutch is same as that of
(a) flat pivot bearing (b) flat collar bearing
(c) conical pivot bearing (d) trapezoidal pivot bearing

h The power transmitted by a belt is maximum when the maximum tension in the belt (T) is equal to
(a) T (b) 2T (c) 3T (d) 4T

i When two pulleys of different diameters are connected by means of an open belt drive, then the angle of contact taken into consideration should be of the
(a) larger pulley (b) smaller pulley (c) average of two pulleys (d) none of these

j Mitre gears are used for
(a) great speed reduction (b) equal speed
(c) minimum axial thrust (d) minimum backlash

k 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

l] A differential gear in an automobile is a
(a) simple gear train (b) epicyclic gear train
(c) compound gear train (d) none of these

n The size of a cam depends upon
(a) base circle (b) pitch circle (c) prime circle (d) pitch curve

n For low and moderate speed engines, the cam follower should move with
(a) uniform velocity (b) cycloidal motion
(c) uniform acceleration and retardation (d) simple harmonic motion

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

Q-2 **Attempt all questions**

(a) Explain any two inversions of double slider crank mechanism with neat sketch. **(07)**

(b) Explain the Kinematic Pairs according to the type of relative motion between the elements. **(07)**

Q-3 **Attempt all questions**

(a) Explain rubbing velocity at a pin joint **(04)**

(b) PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm ; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60 and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS. **(10)**

Q-4 **Attempt all questions**

(a) Derive expression for length of belt for Open belt drive. **(07)**

(b) Explain different types of Flat Belt Drives with neat sketch. **(07)**

Q-5 **Attempt all questions**

(a) Explain terms: 1. Module 2. Circular pitch 3. Diametral Pitch 4. Addendum 5. Dedendum 6. Backlash 7. Pressure angle **(07)**

(b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the Length of path of contact, arc of contact and the contact ratio. **(07)**

Q-6 **Attempt all questions**

(a) Explain with neat sketch different types of cam and followers. **(07)**

(b) A cam is to give the following motion to a knife-edged follower : **(07)**

1. Outstroke during 60□ of cam rotation ; 2. Dwell for the next 30□ of cam rotation ; 3. Return stroke during next 60□ of cam rotation, and 4. Dwell for the remaining 210□ of cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

Q-7 **Attempt all questions**

(a) Derive the equation for torque required to lift the load by a screw jack. **(07)**

(b) The pitch of 50 mm mean diameter threaded screw of a screw jack is 12.5 mm. The coefficient of friction between the screw and the nut is 0.13. Determine the torque required on the screw to raise a load of 25 kN, assuming the load to rotate with the **(07)**

screw. Determine the ratio of the torque required to raise the load to the torque required to lower the load and also the efficiency of the machine

Q-8 **Attempt all questions**

(a) Explain Compound and Reverted gear train with neat sketch. **(07)**

(b) What do you understand by the instantaneous centre of rotation? Discuss the three types of instantaneous centres for a mechanism with neat sketch. **(07)**