

C.U.SHAH UNIVERSITY

Summer Examination-2017

Subject Name: Kinematics and Dynamics of Machines

Subject Code: 4TE03KDM1

Branch: B.Tech (Automobile)

Semester: 3

Date: 27/03/2017

Time : 10:30 To 01:30

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.
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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) Which of the following is an inversion of single slider crank chain?
(a) Beam engine (b) Watt's indicator (c) Elliptical trammels (d) Whitworth quick return motion mechanism
- c) The coriolis component of acceleration is taken into account for
(a) slider crank mechanism (b) four bar chain mechanism
(c) quick return motion mechanism (d) none of these
- d) 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
- e) 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
- f) The velocity ratio of two pulleys connected by an open belt or crossed belt is
(a) directly proportional to their diameters
(b) inversely proportional to their diameters
(c) directly proportional to the square of their diameters
(d) inversely proportional to the square of their diameters
- g) The module is the reciprocal of
(a) diametral pitch (b) circular pitch (c) pitch diameter (d) none of these
- h) The type of gears used to connect two non-parallel non-intersecting shafts are
(a) spur gears (b) helical gearing (c) spiral gearing (d) none of these
- i) The size of a gear is usually specified by
(a) pressure angle (b) circular pitch (c) diametral pitch (d) pitch circle diameter
- j) In a radial cam, the follower moves
(a) in a direction perpendicular to the cam axis
(b) in a direction parallel to the cam axis
(c) in any direction irrespective of the cam axis
(d) along the cam axis
- k) For high speed engines, the cam follower should move with
(a) uniform velocity (b) simple harmonic motion



- (c) uniform acceleration and retardation (d) cycloidal motion
- l) When the pitching of a ship is upward, the effect of gyroscopic couple acting on it will be
 (a) to move the ship towards port side (b) to move the ship towards star-board
 (c) to raise the bow and lower the stern (d) to raise the stern and lower the bow
- m) In order to have a complete balance of the several revolving masses in different planes
 (a) the resultant force must be zero
 (b) the resultant couple must be zero
 (c) both the resultant force and couple must be zero
 (d) none of the above
- n) 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 above

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

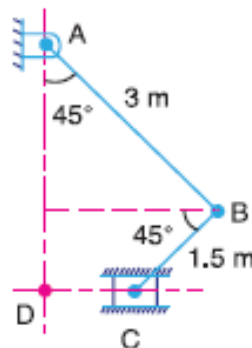
Q-2 Attempt all questions

- (a) Explain Effect of Gyroscopic Couple on a Naval ship with neat sketch. (07)
 (b) Explain balancing of a single rotating mass by two masses rotating in different planes. (07)

Q-3 Attempt all questions

- (a) Explain Rubbing Velocity at a pin joint. (04)
 (b) In the mechanism shown in Fig., the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s^2 . The dimensions of various links are $AB = 3 \text{ m}$ inclined at 45° with the vertical and $BC = 1.5 \text{ m}$ 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.



Q-4 Attempt all questions

- (a) Derive the equation for the length of path of contact of gear. (07)
 (b) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find : (07)
 1. The angle turned through by pinion when one pair of teeth is in mesh ; and



2. The maximum velocity of sliding.

Q-5

Attempt all questions

- (a) Explain different types of flat belt drives with neat sketch. (07)
- (b) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account. (07)

Q-6

Attempt all questions

- (a) Explain types of free vibrations with neat sketch. (07)
- (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. (07)

Q-7

Attempt all questions

- (a) Describe briefly types of Constrained Motions. (04)
- (b) Explain the types of joints in a kinematic chain. (04)
- (c) Explain Hart straight line motion mechanism with the help of neat sketch. (06)

Q-8

Attempt all questions

- (a) Explain classification of cam with neat sketch. (04)
- (b) A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below : (10)
1. To raise the valve through 50 mm during 120° rotation of the cam ;
 2. To keep the valve fully raised through next 30° ;
 3. To lower the valve during next 60° ; and
 4. To keep the valve closed during rest of the revolution i.e. 150° ;
- The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m. Draw the displacement, the velocity and the acceleration diagrams for one complete revolution of the cam.

