R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year II Semester Examinations, November / December-2013
KINEMATICS OF MACHINERY
(Common to ME, MCT, AME, MIM)

Time: 3 hours   Max. Marks: 75

Answer any five questions
All questions carry equal marks
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1.a)   Discuss different types of kinematic pairs giving example for each one of them.
  b)   Explain the terms lower pair, higher pair, kinematic chain and inversion.   [15]

2.a)   Draw the sketch of a mechanism in which a point traces an exact straight line. The mechanism must be made of only revolute pairs. Prove that the point traces an exact straight line motion.
  b)   What are straight line mechanisms? Describe one type of exact straight line motion mechanism with the help of a sketch.   [15]

3.a)   Explain why two Hooke's joints are used to transmit motion from the engine to the differential of an automobile.
  b)   What is the condition for correct steering? Sketch and show the two main types of steering gears and discuss their relative advantages.   [15]

4.a)   Explain how the velocities of a slider and the connecting rod are obtained in a slider crank mechanism.
  b)   The dimensions of the various links of a pneumatic mechanism shown in figure 1 are OA=175mm, AB=180mm, AD=500mm and BC=325mm. Find the velocity ratio between C and ram D when OB is vertical. What will be the efficiency of the machine if a load of 2.5 kN on the piston C causes a thrust of 4 kN at the ram D?   [15]
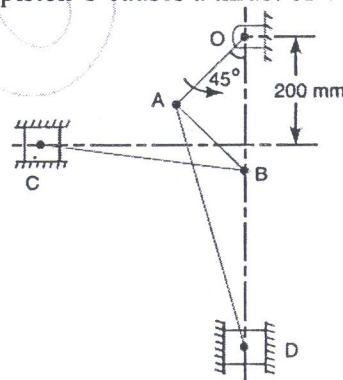

Figure 1

5.a)   State and prove the law of gearing. Show that involute profile satisfies the condition for correct gearing.
  b)   A pinion of 20 involute teeth and 125mm pitch circle diameter drives a rack. The addendum of both pinion and crank is 6.25mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and the minimum number of teeth in contact at a time.   [15]

6.a) Explain the differences between simple, compound and epicyclic gear trains. What are the special advantages of epicyclic gear trains?

b) An epicyclic gear shown in figure 2 train consists of a sun wheel S, a stationary internal gear E and three identical planet wheels P carried on a star shaped planet carrier C. The size of different toothed wheels are such that the planet carrier C rotates at $1/5^{th}$ of the speed of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 N-m. Determine the number of teeth on different wheels of the train and torque necessary to keep the internal gear stationary.
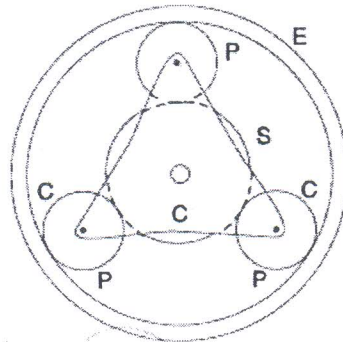
[15]

Figure 2

7.a) Draw the displacement, velocity and acceleration diagrams for a follower when it moves with uniform acceleration and retardation. Derive the expression for velocity and acceleration during outstroke and return stroke of the follower.

b) A symmetrical circular cam operating a flat faced follower has minimum radius of the cam as 30mm, total lift as 20mm, angle of lift as 75^0, nose radius as 5mm, speed as 600rpm. Find the principal dimensions of the cam and the acceleration of the follower at the beginning of the lift at the end of contact with the circular flank at the beginning of contact with nose and at the apex of the nose.

[15]

8.a) Derive an expression for the ratio of the driving tensions in a rope drive assuming the angle of the groove of the pulley to be 2β.

b) A chain drive is used for reduction of speed from 240 rpm to 120rpm. The number of teeth on the driving sprocket is 20. Find the number of teeth on the driven sprocket. If the pitch circle diameter of the driven sprocket is 600mm and centre to centre distance between the two sprockets is 800mm. Determine the pitch and length of the chain.

[15]

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