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06ME44

Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014

Kinematics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Distinguish between:
i) Higher pair and lower pair
ii) Open pair and closed pair
iii) Machine and mechanism **(06 Marks)**

b. Define single slider crank chain. Explain briefly the inversions of single slider crank chain. **(06 Marks)**

c. Sketch the mechanism used to transmit constant angular velocity ratio between two shafts whose axes are separated by a small distance. **(04 Marks)**

d. Use Grubler's criterion to determine the degrees of freedom of the following mechanism. Refer Fig.Q1(d). **(04 Marks)**

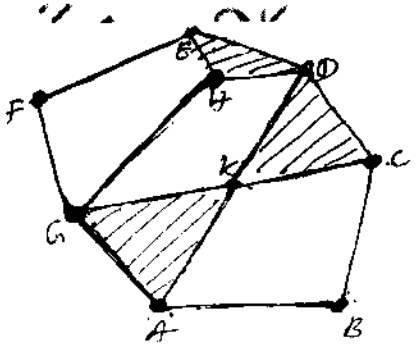

Fig.Q1(d)

2 a. Explain with a neat sketch the working principle of crank and slotted lever mechanism. **(08 Marks)**

b. Explain with a neat sketch the mechanism used to trace exact straight line. **(08 Marks)**

c. Sketch the mechanism used to overcome a very large resistance with a small amount of driving force. **(04 Marks)**

3 Fig.Q3 shows a four bar mechanism. Crank O_2A rotates at 200 rpm and an angular acceleration of 150 rad/sec^2 at the instant when the crank makes an angle of 45° to the horizontal. Find the acceleration of points B and C and angular velocities and angular acceleration of links 3 and 4. **(20 Marks)**

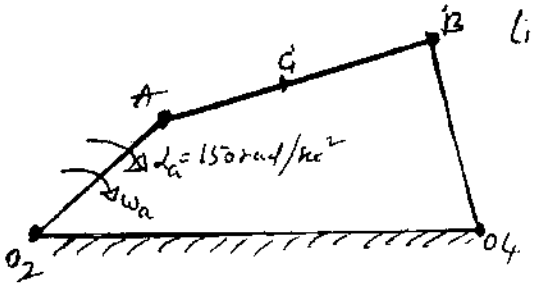

Fig.Q3

4 a. In a slider crank mechanism shown in Fig.Q4(a) the crank OA = 300 mm and the connecting rod AB = 1200 mm the crank OA is turned 30° from the inner dead centre. Locate all the instantaneous centres. If the crank rotates at 15 rad/sec clockwise, find:
i) Velocity of slider B and
ii) Angular velocity of connecting rod AB.

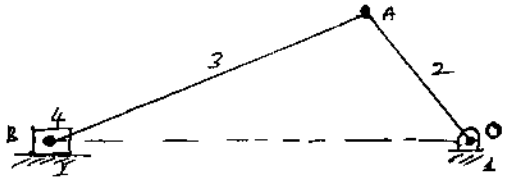

Fig.Q4(a) **(12 Marks)**

b. Determine the velocity and acceleration of the piston by Kelvin's construction to the following specification:
Stroke = 300 mm
Ratio of length of connecting rod to crank radius = 4
Speed of engine = 300 rpm
Position of crank = 45° with inner dead centre. **(08 Marks)**

PART – B

5 In a four bar mechanism ABCD, link AB = 300 mm, BC = 360 mm, CD = 360 mm and the fixed link AD is 600 mm. the angle BAD = 60°. The link AB has an angular velocity of 10 rad/sec and angular acceleration of 30 rad/sec^2 both clockwise. Determine the angular velocities and angular acceleration of link BC and CD by using complex algebra method. **(20 Marks)**

6 a. Briefly discuss interference problems in gears. Deduce an expression for minimum number of teeth on a gear to avoid interference. **(08 Marks)**

b. The following data refers to two mating involute gears of 20° pressure angle. Number of teeth on pinion is 20. Gear ratio = 2, speed of pinion is 250 rpm, module = 12 mm. If the addendum on each wheel is such that the path of approach and the path of reuse on each side are half of the maximum permissible length. Find the maximum velocity of sliding during path of approach and path of recess and the length of arc of contact. **(12 Marks)**

7 a. Deduce an expression for holding torque in epicyclic gear train. **(05 Marks)**

b. An epicyclic gear train arrangement consists of three planet wheels of equal size and equispaced (120° apart) carried by a spider (arm). The three planet wheels mesh externally with a sun wheel and internally with an annular ring, which is stationary. The pitch circle diameter of the ring is approximately 228 mm and module is 4 mm. The spider makes one revolution for every five revolutions of the spindle carrying the sun wheel. Determine the number of teeth for all the gears and the exact pitch circle diameter of the ring. If a torque of 30 N-m is applied to the sun wheel, determine the torque required to hold the ring stationary. **(15 Marks)**

8 Draw to full size the profile of cam which gives a lift of 38 mm to a follower carrying a roller of 25 mm diameter. The axis of the follower is offset by 18 mm to the right of the axis of cam. Ascent of the follower takes place with SHM during 0.05 seconds followed by a period of rest during 0.0125 seconds the follower then descends with UARM during 0.125 seconds, the acceleration being 3/5 times the retardation the follower remains at rest during the remaining period of cam rotation. The cam rotates in clockwise direction at a constant speed of 240 rpm and base circle radius is 50 mm. Also determine maximum velocity, uniform acceleration, uniform retardation of the follower during return stroke. **(20 Marks)**

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