B.E.(with Credits)-Regular-Semester 2012-Mechanical Engineering Sem III

ME 303 - Kinematics of Machines

P. Pages : 3 **GUG/W/16/3792**

Time : Three Hours * 3 6 3 2 * Max. Marks : 80

Notes : 1. Solve Q. 1 or 2, 3 or 4, 5 or 6, 7 or 8 and 9 or 10.
2. All questions marks as indicated.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of non-programmable calculator and Drawing instruments, is permitted.

1. a) What is kinematic inversion ? Explain the inversions of double slides crank chain with suitable sketches. **8**

b) In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres O and C is 200 mm. The driving crank CP is 75 mm long. The pin Q on the slotted lever, 360 mm from the fulcrum O, is connected by a link QR 100 mm long to a pin R on the ram. The line of stroke of R is perpendicular to OC and intersects OC produced at point 150 mm from C. Determine : **8**
i) Time Ratio
ii) Length of stroke of R.

OR

2. a) Explain Harding's notation with suitable examples. **3**

b) With a neat sketch explain the working of Geneva wheel. **4**

c) Determine the degrees of freedom of the mechanism shown in fig. Q. 2 (c). **9**

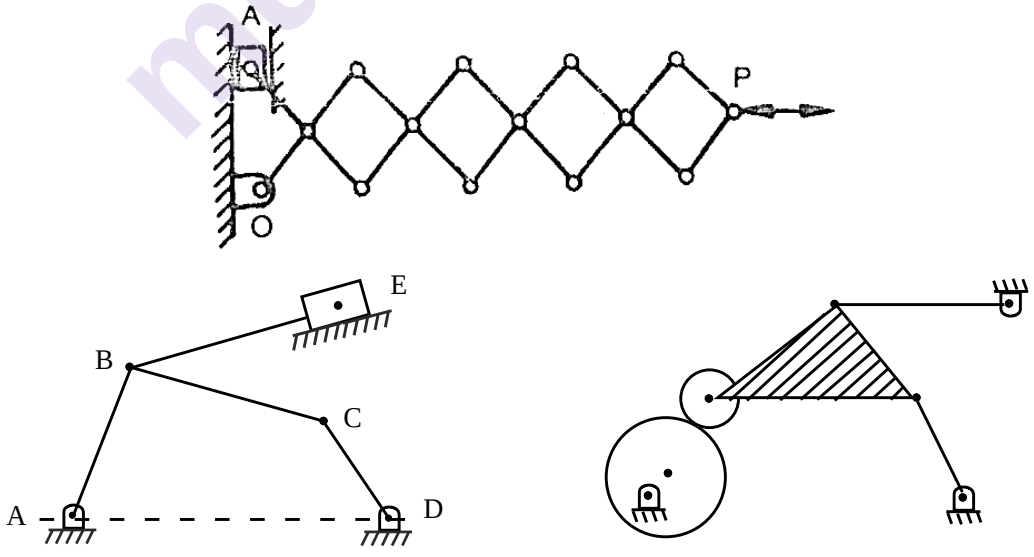

Fig. Q. 2 (C)

3. In the mechanism, as shown in fig. Q. 3 the crank OA rotates at 20 rpm anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA = 300 mm, AB = 1200 mm, BC = 450 mm and CD = 450 mm. **16**

For the given configuration, determine :

i) Velocities of sliding of B and D.

ii) Angular velocity of CD

iii) Linear acceleration of D and

iv) Angular acceleration of CD.

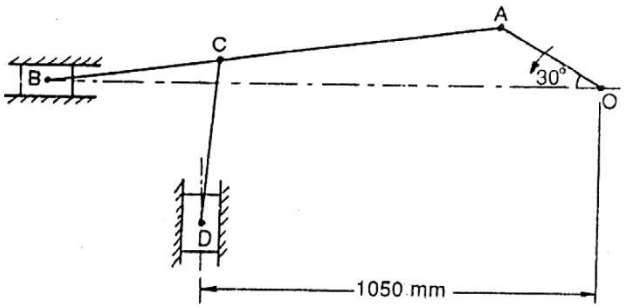

Fig. Q. 3

OR

4. a) State and prove Kennedy's theorem. **6**

b) Locate all the instantaneous centres for the crossed four bar mechanism as shown in fig. Q. 4 (b). The dimensions of various links are : **10**
CD = 65 mm, CA = 60 mm, DB = 80 mm and AB = 55 mm.
Find the angular velocities of the links AB and DB, if the crank CA rotates at 100 rpm in anticlockwise direction.

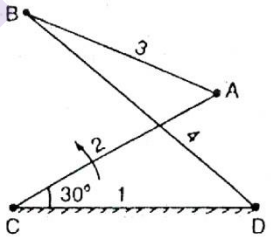

Fig. Q. 4 (b)

5. Draw a profile of a cam to noise a valve with cycloidal motion through 50 mm in 1/3 of a revolution, keep it fully raised through 1/12 revolution and to lower it with simple harmonic motion in 1/6 revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 20 mm and the minimum radius of the cam is 25 mm. The axis of the valve rod passes through the axis of the cam. If the cam rotates at uniform speed of 100 rpm clockwise, find the maximum velocity and acceleration of a valve during raising. **16**

OR

6. a) What is tangent cam ? Derive expressions for displacement, velocity and acceleration for a tangent cam operating on a radial translating roller follower when the contact is on straight flank. **8**

b) The following particulars refer to a symmetrical circular arc cam operating a flat faced follower whose centre line passes through cam centre - **8**
Least radius = 1.6 cm
Nose radius = 0.4 cm
Distance between cam shaft centre and nose centre = 2.5 cm
Angle of action of cam = 150^o
Cam shaft speed = 100 rad/sec
Assuming that there is no d well between ascent and descent.
Calculate : i) Lift of the valve ii) Flank radius

7. a) Explain the following terms : **6**
i) Module ii) Addendum iii) Pressure angle.

b) The number of teeth in gear 1 and 2 are 60 and 40 ; module = 3 mm, pressure angle = 20^o and addendum = 0.318 of the circular pitch. Determine the contact ratio and the velocity of sliding when the contact is at the fip of the teeth of gear 2 if gear 2 rotates at 800 rpm. **10**

OR

8. a) Derive an expression for the minimum number of teeth on the gear in order to avoid the interference in involute gear. **6**

b) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20^o pressure angle. If the addendum on each wheel is such that the path of contact is maximum and interference is just avoided, find the addendum for each wheel, path of contact, arc of contact and contract ratio. **10**

9. a) Explain the term 'train value' how do you find it for - **6**
i) compound gear train ii) reverted gear train

b) Fig. Q. 9 (b) shows an epicyclic gear train. The gears have number of teeth as indicated. Gear 1 is fixed to the frame and is stationary the arm a and the gears 2 and 3 are free to rotated on the shafts. The pitch circle diameters of all the gears are the same so that the planet gear P meshes with them all. Find the number of revolution of gears 2 and 3 for one revolution of arm a. **10**

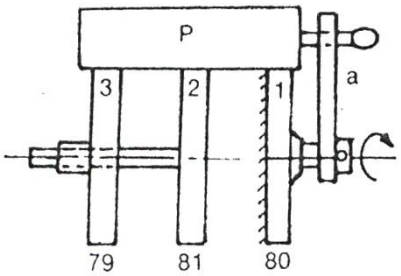

Fig. Q. 9 (b)

OR

10. a) Derive an expression for the centre distance of a pair of spiral gears. **6**

b) The spiral gear wheels A and B have 45 and 15 teeth at spiral angles of 20^o and 50^o respectively. Both wheels are of same hand. The wheel having 45 teeth is 15 cm in diameter. Determine the distance between the shaft and angle between the shafts. **10**
If the teeth cut are of involute form with pressure angle of 20^o and coefficient of friction is 0.08, determine the efficiency of gears if -
i) A is driver ii) B is driver.

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