

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-IV • EXAMINATION – WINTER • 2014

Subject Code: 141902

Date: 31-12-2014

Subject Name: Kinematics of Machines

Time: 02:30 pm - 05:00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Define Number of degree of freedom and determine the number of degree of freedom 07
 for the mechanisms shown in Fig.1, 2, 3

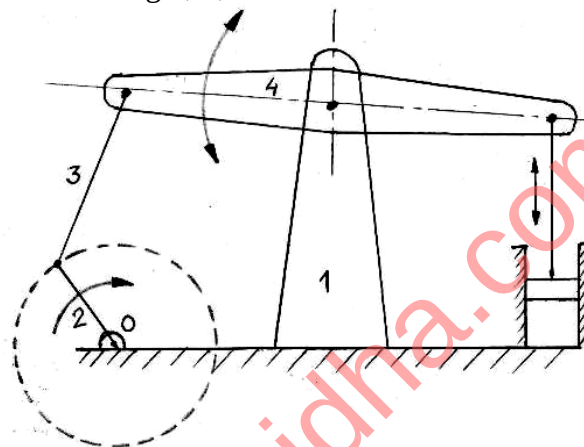


Figure 1

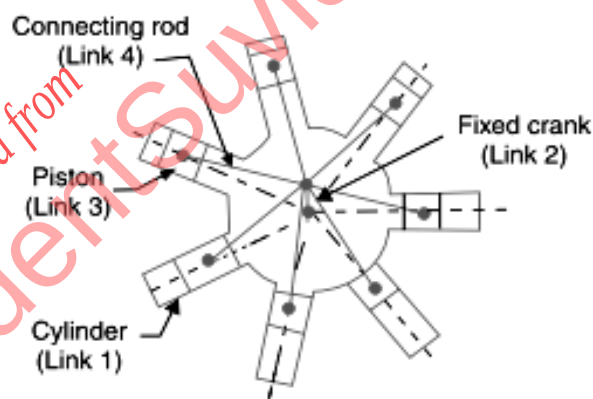


Figure 2

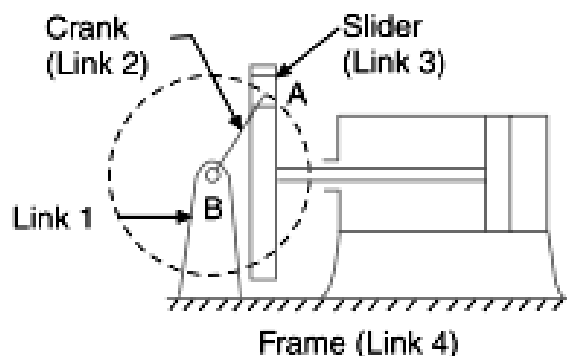


Figure 3

- (b)** Determine the condition for Correct Steering and also verify the condition for Davis 07
 Steering Gear.

Q.2 (a) Define :

04

1. Space Centrode
2. Body Centrode
3. Fixed instantaneous Centre
4. Permanent instantaneous Centre

- (b) In the mechanism, as shown in Fig. 4, the crank OA rotates at 20 r.p.m. 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. For the given configuration, determine: 1. velocities of sliding at B and D, 2. Angular velocity of CD, 3. linear acceleration of D, and 4. angular acceleration of CD. 10

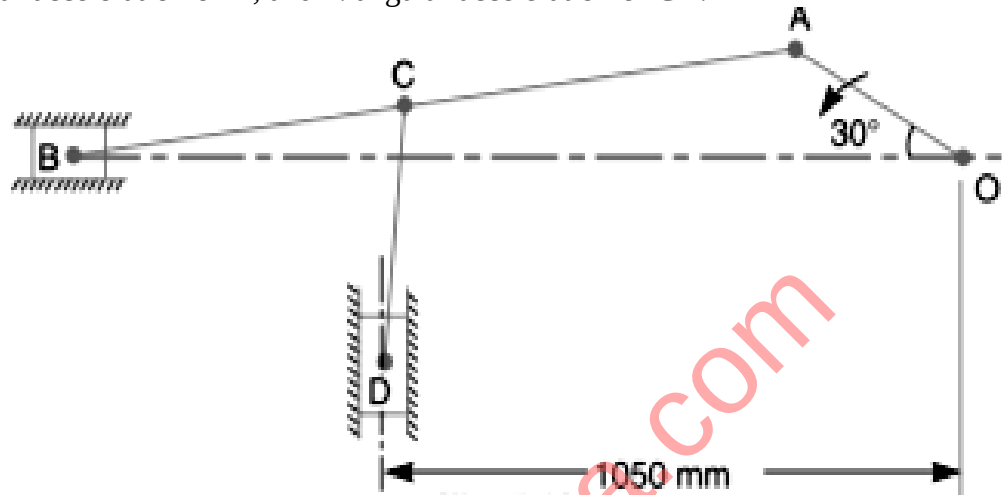


Figure 4

OR

- (b) In Fig. 5, the angular velocity of the crank OA is 600 rpm. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are: OA = 28 mm; AB = 44 mm; BC = 49 mm; and BD = 46 mm. The centre distance between the centres of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical. 10

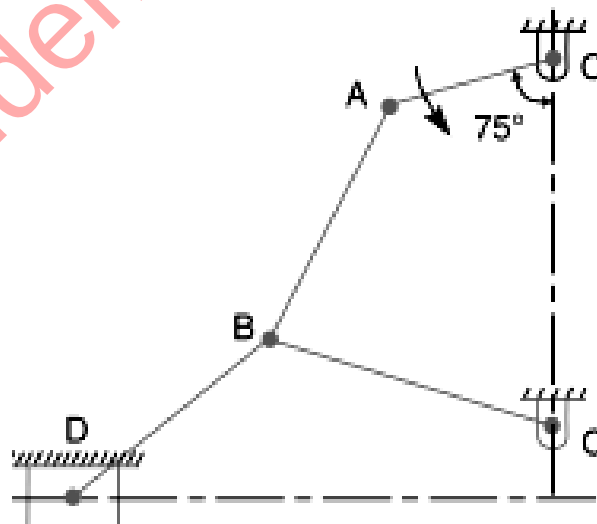


Figure 5

- Q.3 (a) Define Centrifugal tension for flat belt also discuss the effect of centrifugal tension on power transmission. 05

- (b) A pulley used to transmit power by means of ropes has a diameter of 3.6 metres and has 15 grooves of 45° angle. The angle of contact is 170° and the coefficient of friction between the ropes and the groove sides is 0.28. The maximum possible tension in the ropes is 960 N and the mass of the rope is 1.5 kg per metre length. What is the speed of pulley in rpm and the power transmitted if the condition of maximum power prevail? **09**

OR

- Q.3 (a)** Derive the expression for length of the chain with usual notation. **05**
(b) A belt drive is required to transmit 10 KW from motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 gm/mm^3 . Safe stress in the belt is not exceeding 2.5 N/mm^2 . Diameter of the driving pulley is 250 mm whereas the speed of the driven pulley is 220 rpm. The two shafts are 1.25 m apart. The coefficient of friction is 0.25. Determine the width of the belt. **09**

- Q.4 (a)** Define Interference for Involute Gears and derive expression the minimum number of teeth. **05**
(b) A pair of involute spur gears with 16° pressure angle and pitch of module 6 mm is in mesh. The number of teeth on pinion is 16 and its rotational speed is 240 rpm. When the gear ratio is 1.75, find in order that the interference is just avoided; 1. The addenda on pinion and gear wheel; 2. The length of path of contact; and 3. The maximum velocity of sliding of teeth on either side of the pitch point. **09**

OR

- Q.4 (a)** Derive the expression for the length of path of contact and length of arc of contact. **05**
(b) Two 20° involute spur gears have a module of 10 mm. the addendum is one module. The larger gear has 50 teeth and the pinion 13 teeth. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference? **09**

- Q.5 (a)** Explain the working of Cone clutch with neat sketch. **04**
(b) Construct the profile of a cam to suit the following specifications : **10**
Cam shaft diameter = 40 mm; Least radius of cam = 25 mm; Diameter of roller = 25 mm; Angle of lift = 120° ; Angle of fall = 150° ; Lift of the follower = 40 mm; Number of pauses are two of equal interval between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of the cam.

OR

- Q.5 (a)** Explain the working of Multi-plate clutch with neat sketch. **04**
(b) Draw the profile of a cam operating a knife edged follower having lift of 30 mm. the cam raises the follower with simple harmonic motion for 150° of its rotation followed by a period of dwell for 60° . The follower descends for the next 100° rotation of cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has least radius of 20 mm. what will be the maximum velocity and acceleration of the follower during the lift and the return? **10**
