

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 141902

Date: 29/12/2012

Subject Name: Kinematics of Machines

Time: 02.30 pm - 05.00 pm

Total Marks: 70

Instructions:

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

Q.1 (a) Draw the profile of a cam operating a roller reciprocating follower and with the following data: **14**

Minimum radius of cam = 25 mm ,

Lift = 30 mm,

Roller Diameter = 15 mm

The cam lifts the follower for 120° with SHM followed by a dwell period of 30° . Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of the 150 rpm, Calculate the maximum velocity and acceleration of the follower during the ascent and descent period. Also draw the displacement, velocity and acceleration diagram for the motion of the follower for one complete revolution of the cam.

Q.2 (a) Explain various inversion of a slide-crank mechanism with the help of example. **07**

(b) Discuss with neat sketch different types of steering gear mechanism of automobile in detail. **07**

OR

(b) Explain Hart straight line motion mechanism with the help of neat sketch and prove that tracing point describes a straight line path. **07**

Q.3 (a) Derive analytical expression for the displacement and velocity analyses of a slider crank mechanism. **07**

(b) For the mechanism shown in Fig.1 crank OA rotates at 150 rpm clockwise. Using Instantaneous Center Method determine the linear velocity of the points B, C and D and angular velocities of links AB, BC and CD. OA = 100 mm, AB = 580 mm, BC = 300 mm, CD = 350 mm and BE = 200 mm. **07**

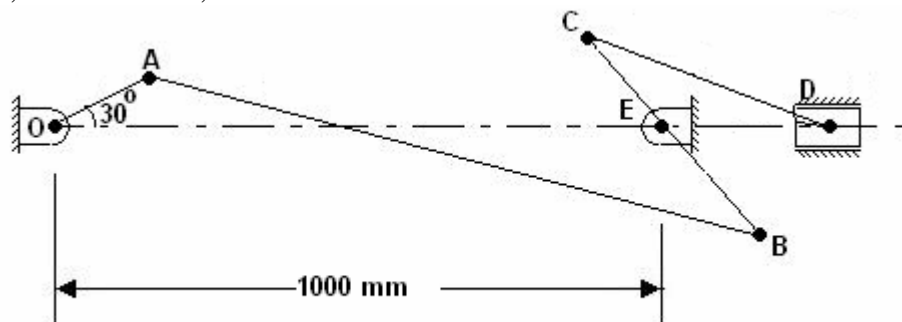


Fig.1

OR

Q.3 Fig.2 shows the link mechanism of a quick-return mechanism of a slotted – **14**

lever type, the various dimensions of which are $OA = 400\text{mm}$, $OP = 200\text{mm}$, $AR = 700\text{ mm}$, $RS = 300\text{ mm}$ For the configuration shown, determine the acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates at 210 rpm.

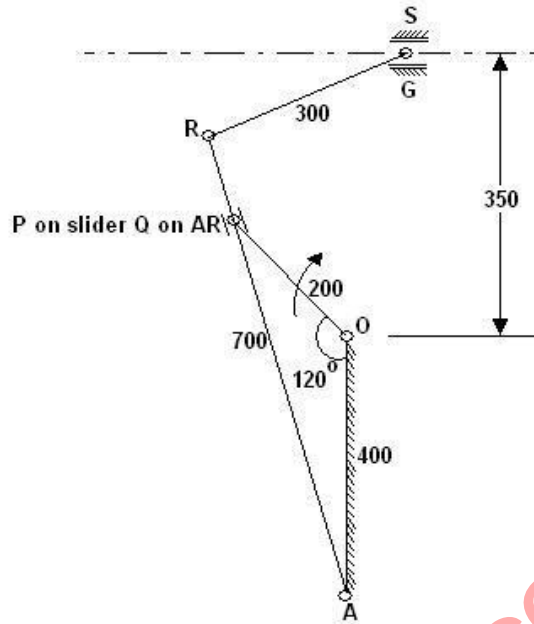


Fig.2

- Q.4 (a)** Derive expression for exact and approximate length of belt in an open belt drive. **07**
- (b)** For a single plate friction clutch, the external and internal radii are 140 mm and 70 mm, and it transmits 20 kW at 2000 rpm. For uniform wear theory, determine the maximum, minimum and average pressure at the contact surfaces. Assume $\mu = 0.3$. **07**
- OR**
- Q.4 (a)** In an open belt drive, the linear velocity of the belt is 3 m/s. The angle of lap on the smaller pulley is 166° , the co-efficient of friction is 0.3 and power transmitted is 3 kW. **07**
Determine the effect of power transmission in the following cases:
- (i) Initial tension in the belt is increased by 10%.
 - (ii) Angle of lap is increased by 10% by the use of an idler pulley, for the same speed and tension on tight side.
 - (iii) μ is increased by 10%.
- Q.4 (b)** Derive an expression for the efficiency of an inclined plane when a body moves up a plane. **07**
- Q.5 (a)** Derive an expression for the length of the path of contact for two involute profile gear in mesh. **07**
- (b)** Fig. 3 shows an epicyclic gear train. Pinion A has 15 teeth and is rigidly fixed in motor shaft. The wheel B has 20 teeth and gears with A, and also with annular fixed wheel D. Pinion C has 15 teeth and is integral with B (C, B being a compound gear wheel). Gear C meshes with annular wheel E, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheel B, C. If the motor runs at 1000 rpm, find the speed of the machine shaft. Find the torque exerted on the machine shaft if motor develops a torque of 100 Nm. **07**

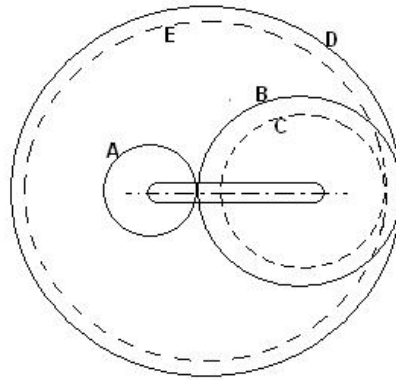


Fig. 3

OR

- Q.5 (a)** Two 20° involute spur gear mesh externally and give a velocity ratio of 3. The module is 3 mm and the addendum is equal to 1.1 modules. If the pinion rotates at 120 rpm, determine: **07**
- (i) minimum number of teeth on each wheel to avoid interference
 - (ii) Contact Ratio.
- (b)** Explain epicyclic gear train with the help of neat sketch. Write its merits and demerits as compared to reverted and compound gear trains. **07**

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