Code: 13A03401 **R13**

B.Tech II Year II Semester (R13) Supplementary Examinations May/June 2017

KINEMATICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Differentiate lower and higher pairs with examples.
(b) Define degrees of freedom.
(c) What is a Hooke's joint and where is it used?
(d) What is centrifugal tension in a belt? How does it affect the power transmitted?
(e) Define Kennedy's theorem.
(f) What are centripetal and tangential components of acceleration?
(g) Write down the differences between involute and cycloidal tooth profile.
(h) What is the function of a differential gear of an automobile?
(i) Define cam. What are the uses of cam and follower?
(j) Compare the performance of roller and mushroom follower of a cam.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 What is known as kinematic inversion? Sketch and explain the inversions of a double slider crank chain.

OR

3 What are straight line mechanisms? Sketch the Peaucellier straight line motion mechanism and prove that the generating point moves in straight line.

UNIT – II

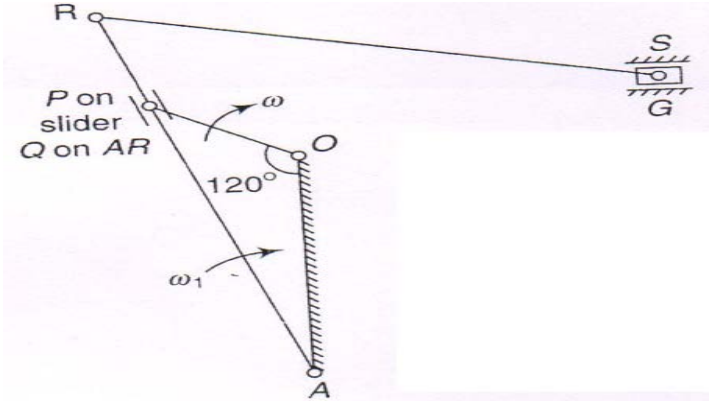
4 (a) Derive the condition for correct steering. Which steering gear fulfils this condition and why?
(b) The ratio between the width of the front axle and that of the wheel base of a steering mechanism is 0.44. At the instant when the front inner wheel is turned by 18°, what should be the angle turned by the outer wheel for perfect steering.

OR

5 A belt drive transmits 8 kW of power from a shaft rotating at 240 rpm to another shaft rotating at 160 rpm. The belt is 8 mm thick. The diameter of the smaller pulley is 600 mm and the two shafts are 5 m apart. The coefficient of friction is 0.25. If the maximum stress in the belt is limited to 3 N/mm^2, find width of the belt for: (i) An open belt drive. (ii) A cross-belt drive.

UNIT – III

6 Below figure shows the link mechanism of a quick return mechanism of the slotted lever type, the various dimensions of which are OA = 400 mm, OP = 200 mm, AR = 700 mm, RS = 300 mm. For the configuration shown, determine the velocity of the cutting tool at S and the angular velocity of the link RS. The crank OP rotates at 210 rpm.



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OR

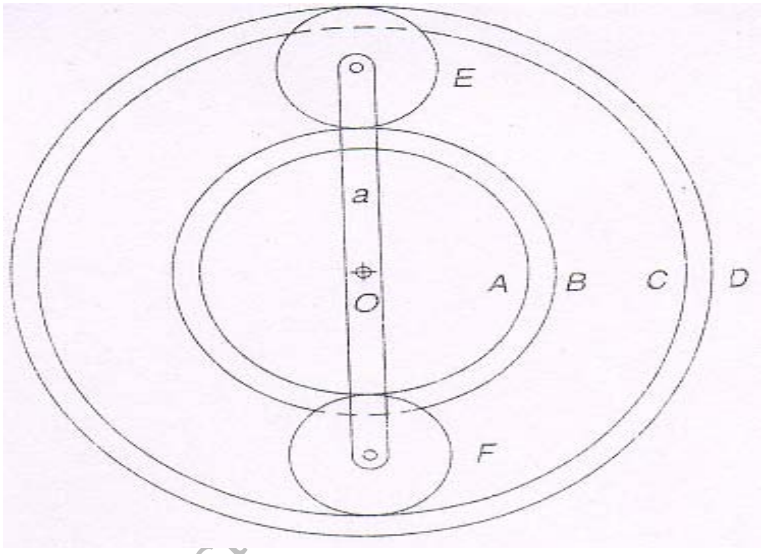
7 Locate all the instantaneous centers of the slider crank mechanism. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank has turned 45° clockwise from the inner dead center position with an angular velocity of 10 rad/sec, find the velocity of slider A and angular velocity of the connecting rod AB.

UNIT – IV

8 Two involute gears of 20° pressure angle are in mesh. The number of teeth on the pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find: (i) The angle turned through by pinion when one pair of teeth is in mesh. (ii) The maximum velocity of sliding.

OR

9 In the epicyclic gear train shown in the below figure, the compound wheels A and B as well as internal wheels C and D rotate independently about the axis O. The wheels E and F rotate on the pins fixed to the arm a. All the wheels are of the same module. The number of teeth on the wheels are T_A = 52, T_B = 56, T_E = T_F = 36. Determine the speed of C if: (i) The wheel D fixed and arm a rotates at 200 rpm clockwise. (ii) The wheel D rotates at 200 rpm counter- clockwise and the arm a rotates at 20 rpm counter-clockwise.



UNIT – V

10 A cam with a minimum radius of 25 mm is to be designed for a knife-edge follower with the following data:
(i) To raise the follower through 35 mm during 60° rotation of the cam.
(ii) Dwell for next 40° of the cam rotation.
(iii) Descending of the follower during the next 90° of the cam rotation.
(iv) Dwell during the rest of the cam rotation.
Draw the profile of the cam if the ascending and descending of the cam is with simple harmonic motion and the line of stroke of the follower is offset 10 mm from the axis of the cam shaft. What is the maximum velocity and acceleration of the follower during the ascent and descent if the cam rotates at 150 rpm?

OR

11 In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate: (i) The principal dimensions of the cam. (ii) The acceleration of the follower at the beginning of the lift, where straight flank merges into a circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent.

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