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Question Paper Code : 51846

B.E./B. Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Third Semester

Mechanical Engineering

ME 2203/ME 35/ME 1202 A/080120010/10122/ME 404 – KINEMATICS OF MACHINERY

(Regulations 2008/2010)

(Common to PTME 2203/10122 ME 404 – Kinematics of Machinery for B.E. (Part-Time)

Third/Fourth Semester Mechanical Engineering – Regulations 2009/2010)

Time : Three Hours

Maximum : 100 Marks

Note: A3 drawing sheet is to be supplied to all students.

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. How to determine the given assemblage of links forms the kinematic chain or not ?
2. What is meant by motion adjustment mechanism?
3. Difference between radial component of acceleration and tangential component of acceleration.
4. How are velocity and acceleration of the slider of a single slider crank chain determined analytically ?
5. Differentiate roller and mushroom follower of a cam.
6. What is the maximum acceleration of a follower moving with simple harmonic motion ?

7. What is meant by arc of approach, arc of recess and arc of contact ?
8. How epicyclic gear train differs from the other types of gear trains ?
9. A block of 50 N rests on a horizontal plane and whose co-efficient of friction is 0.25. What is the force required to pull the block at an angle 30° to the horizontal ?
10. What is the condition for transmission of optimum or maximum power in belt drive ?

Part – B (5 × 16 = 80 Marks)

11. (a) (i) Show that the locus of the mid-point of the link connecting the two sliders in an elliptical trammel is a circle. (8)
- (ii) Explain mechanical advantage and transmission angle related to four-bar mechanisms. (8)

OR

- (b) (i) The distance between two parallel shafts is 15 mm and they are connected by an Oldham's coupling. The driving shaft revolves at 150 r.p.m, what will be the maximum speed of sliding of the tongue of the intermediate piece along its groove ? (8)
 - (ii) With neat sketches explain any two straight line generator mechanisms. (8)
12. (a) In figure, the angular velocity of the crank OA is 600 r.p.m. 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. (Refer fig. 12(a)) (16)

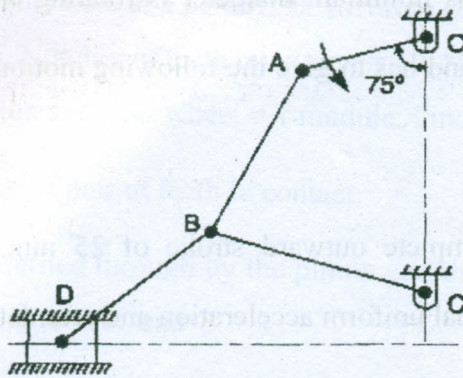


Fig. 12 (a)

OR

- (b) In a mechanism shown in figure, the crank OA is 100 mm long and rotates clockwise about O at 120 r.p.m. The connecting rod AB is 400 mm long. At a point C on AB, 150 mm from A, the rod CE 350 mm long is attached. This rod CE slides in a slot in a trunnion at D. The end E is connected by a link EF, 300 mm long to the horizontally moving slider F. For the mechanism in the position shown. find : (Refer fig. 12(b))

(16)

- (1) Velocity of F,
- (2) Velocity of sliding of CE in the trunnion, and
- (3) Angular velocity of CE.

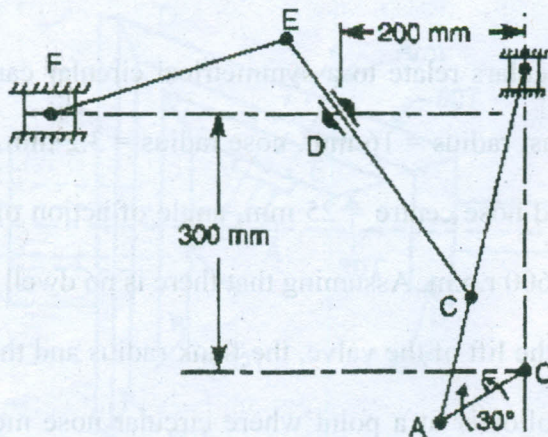


Fig. 12 (b)

13. (a) A cam with 30 mm as minimum diameter is rotating clockwise at a uniform speed of 1200 r.p.m. and has to give the following motion to a follower 10 mm in diameter :

(i) Follower to complete outward stroke of 25 mm during 120° of cam rotation with equal uniform acceleration and retardation;

(ii) Follower to dwell for 60° of cam rotation;

(iii) Follower to return to its initial position during 90° of cam rotation with equal uniform acceleration and retardation;

(iv) Follower to dwell for the remaining 90° of cam rotation.

Draw the cam profile if the axis of the roller follower passes through the axis of the cam. Determine the maximum velocity of the follower during the outstroke and return stroke and also the uniform acceleration of the follower on the out stroke and the return stroke. (16)

OR

(b) The following particulars relate to a symmetrical circular cam operating a flat faced follower : Least radius = 16 mm, nose radius = 3.2 mm, distance between cam shaft centre and nose centre = 25 mm, angle of action of cam = 150° , and cam shafts speed = 600 r.p.m. Assuming that there is no dwell between ascent or descent, determine the lift of the valve, the flank radius and the acceleration and retardation of the follower at a point where circular nose merges into circular flank. (16)

14. (a) The following data relate to a pair of 20° involute gears in mesh :
 Module = 6 mm, Number of teeth on pinion = 17, Number of teeth on gear = 49;
 Addenda on pinion and gear wheel = 1 module. Find :

1. The number of pair of teeth in contact;
2. The angle turned through by the pinion and the gear wheel when one pair of teeth is in contact, and
3. The ratio of sliding to rolling motion when the tip of a tooth on the larger wheel,
 - (i) is just making contact,
 - (ii) is just leaving contact with its mating tooth, and
 - (iii) is at the pitch point.

(16)

OR

- (b) In a gear train, as shown in figure, gear B is connected to the input shaft and gear F is connected to the output shaft. The arm A carrying the compound wheels D and E, turns freely on the output shaft. If the input speed is 1000 r.p.m. counter-clockwise when seen from the right, determine the speed of the output shaft under the following conditions : (1) When gear C is fixed, and (2) When gear C is rotated at 10 r.p.m. counter clockwise. (Refer fig. 14(b))

(16)

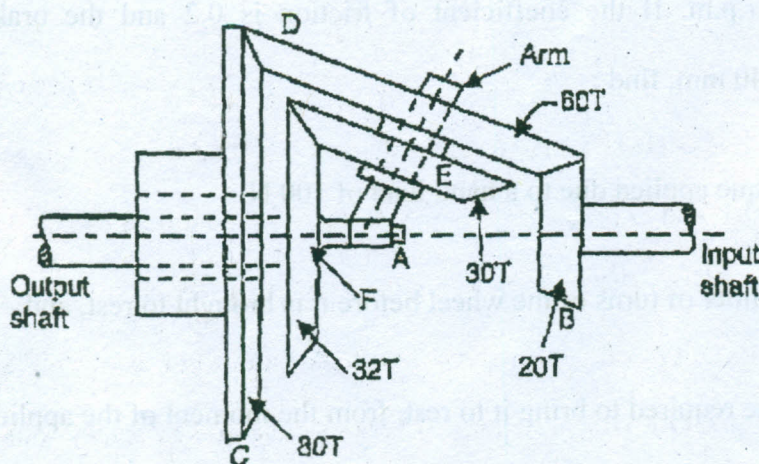


Fig. 14 (b)

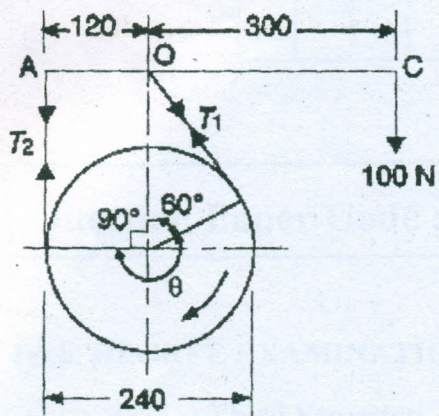
15. (a) (i) The pitch of 50 mm mean diameter threaded screw of a screw jack is 12.5 mm. The coefficient of friction between the screw and the nut is 0.13. Determine the torque required on the screw to raise a load of 25 kN, assuming the load to rotate with the screw. Determine the ratio of the torque required to raise the load to the torque required to lower the load and also the efficiency of the machine. (8)

(ii) A leather faced conical clutch has a cone angle of 30° . If the intensity of pressure between the contact-surfaces is limited to $0.35 \times \text{N/mm}^2$ and the breadth of the conical surface is not to exceed one-third of the mean radius, find the dimensions of the contact surfaces to transmit 22.5 kW at 2000 r.p.m. Assume uniform rate of wear and take coefficient of friction as 0.15. (8)

OR

(b) The simple band brake, as shown in figure, is applied to a shaft carrying a flywheel of mass 400 kg. The radius of gyration of the flywheel is 450 mm and runs at 300 r.p.m. If the coefficient of friction is 0.2 and the brake drum diameter is 240 mm, find :

- (1) The torque applied due to a hand load of 100 N,
- (2) The number of turns of the wheel before it is brought to rest, and
- (3) The time required to bring it to rest, from the moment of the application of the brake. (Refer fig. 15(b)) (16)



All dimensions in mm

Fig. 15 (b)