309403

May, 2019

B.Tech. (ME) - IV SEMESTER

Kinematics of Machines (PCC-ME-206)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*

2. *Answer any four questions from Part-B in detail.*

3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Distinguish between mechanism and machine. (1.5)

    (b) Define mechanical advantage and transmission angle of a mechanism. (1.5)

    (c) What is velocity of rubbing? (1.5)

    (d) What is instantaneous centre of rotation? (1.5)

    (e) What is a pantograph? (1.5)

    (f) What is a Hook's joint? Where it is used? (1.5)

(g) How are cams classified? (1.5)

(h) Define pitch circle and pitch point. (1.5)

(i) What is pressure line and pressure angle of a gear?

(1.5)

(j) What is the advantage of self-expanding shoe brake?

(1.5)

PART–B

2. (a) Determine the number of simple hinges in a six link mechanism having single degree of freedom. Also obtain the number of binary and ternary links in such a mechanism. (10)

(b) Determine the maximum permissible angles between the shaft axes of a universal joint if the driving shaft rotates at 840 rpm and the total fluctuation of speed does not exceed 60 rpm. Also find the maximum and minimum speeds of the driven shaft. (5)

3. (a) In a four bar mechanism ABCD, AD is fixed and is 100 mm long. The crank AB is 25 mm long and rotates at 100 rpm clockwise, while the link CD = 50 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of the link CD when angle BAD = 60°. (5)

(b) The crank of a slider crank mechanism rotates at a constant speed of 280 rpm. The crank is 140 mm long and the connecting rod is 600 mm long. Determine: angular velocity and angular acceleration of the connecting rod at a crank angle of 45° from inner dead centre position. (10)

4. Design a four-link mechanism if the motions of the input and output links are governed by a function $y = x^{1.5}$ and x varies from 1 to 4. Assume θ to vary from 30° to 120° and ψ from 60° to 130°. The length of the fixed link is 30 mm. Use Chebychev spacing of accuracy points. (15)

5. (a) Derive a relation for minimum number of teeth on the gear wheel and the pinion to avoid interference. (5)

(b) In an epicyclic gear train, the internal wheels A and B and the compound wheels C and D rotate independently about O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have same module and the number of teeth are:

$T_C = 26$, $T_D = 24$, $T_E = T_F = 16$

(i) Sketch the arrangement.

(ii) Find the number of teeth A and B.

(iii) If the arm G makes 100 rpm clockwise and A is fixed, find the speed B.

(iv) If the arm G makes 100 rpm clockwise and wheel a makes 10 rpm counter clockwise, find the speed of wheel B. (10)

6. (a) Deduce expressions for the velocity and acceleration of the follower when it moves with simple harmonic motion. (5)

(b) Draw the profile of a cam operating a knife edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and return? (10)

7. (a) A band and block brake having 12 blocks, each of which subtends an angle of 18° at the centre, is applied to the rotating drum with a diameter of 620 mm. the blocks are 80 mm thick. The drum and the flywheel mounted on the same shaft have a mass of 1800 kg

and have a combined radius of gyration of 600 mm. The two ends of the band are attached to pins on the opposite sides of the brake fulcrum at distances of 40 mm and 150 mm from it. If a force of 250 N is applied on the lever at a distance of 900 mm from the fulcrum, find the

(i) maximum braking torque

(ii) angular acceleration of the drum

(iii) time taken by the system to be stationary from the rated speed of 300 rpm.

Take the coefficient of the friction between the blocks and drum as 0.3. (10)

(b) With the help of a neat sketch, explain transmission dynamometer. (5)

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