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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M.Tech DEGREE EXAMINATION MAY/JUNE 2016
(2015 Admissions)
MACHINE DESIGN
04 ME 6506: ADVANCED THEORY OF MACHINES

Time: 3 hrs Max. Marks: 60

PART A

(Answer all questions. Each question carry 3 marks).

1. Define instantaneous centre. (3)
2. Define pole and inflection circle. (3)
3. Define transmission angle. (3)
4. What is Chebyshev spacing? (3)
5. State D'Alembert's principle with necessary equations. (3)
6. What is pin joint friction? (3)
7. Draw the displacement, velocity & acceleration profiles with respect to angular displacement of the cam for simple harmonic motion of a follower (3)
8. State Euler's equation of motion. (3)

PART B

(Each full question carries 6 marks).

9. A mechanism as shown in figure 1 has the following dimension $OA = 200\,mm$, $AB = 1.5\,m$, $BC = 600\,mm$, $CD = 500\,mm$ & $BE = 400\,mm$. Locate all the instantaneous centers. If crank OA rotates uniformly at $120\,rpm$ clockwise, Find (a) Velocity of B (b) Angular velocity of link AB (6)

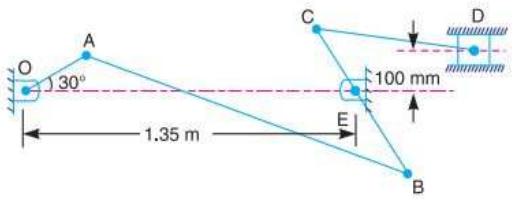

Figure 1:

OR

10. Define the Corioli's component of acceleration. Derive an expression for it. (6)

11. Derive Euler savary equation and explain its significance (6)

OR

12. Use Bobillier theorem to determine the centre of curvature of the coupler drive of the point E of the four bar mechanism shown in figure. The dimensions are $AD = AB = 60\,mm$, $BC = CD = 25\,mm$. AD is fixed link and E is the midpoint of BC (6)

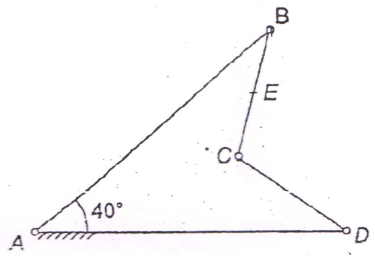

Figure 2:

13. Design a slider crank mechanism to coordinate three positions of the input link and the slider for the following angular and linear displacements of the input link and the slider respectively, $\theta_{12} = 30^0$, $S_{12} = 100\,mm$, $\theta_{13} = 90^0$,$S_{13} = 200\,mm$. Take the eccentricity of the slider as $10\,mm$. Use the relative pole method. (6)

OR

14. Design a four link mechanism if the motions of the input and output links are governed by a function $y = x^{1.5}$ & x varies from 1 to 4. Assume θ to vary from 30^0 to 120^0 and ϕ from 60^0 to 130^0. The length of the fixed link is $30\,mm$. Use chebychev spacing of accuracy of points. (6)

15. A cam consist of a circular disc of diameter $75\,mm$ with its centre displaced with $25\,mm$ from the cam shaft axis the follower has a flat in contact with the cam and the line of action of the follower is vertical and passes through the shaft axis as shown in fig 3. The mass of the follower is $2.3\,kg$. and is pressed downwards with a spring stiffness $3.5\,N/mm$. In the lower position of the spring force is $45\,N$. Derive an expression for the acceleration of the follower as a function of cam rotation from the lowest position of the follower. Also find the speed at which the follower begins to lift from the cam surface. (6)

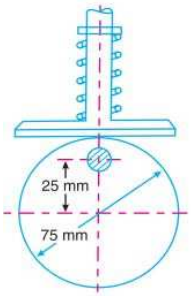

Figure 3:

OR

16. Describe the dynamic of a cam system. How will one carry out the dynamic force analysis of a cam? (6)

17. For the static equilibrium of quick return mechanism determine the input torque T_2 to be applied on link AB for a force of $300\,N$ on the slider D. the dimensions of various links are $OA = 400\,mm$, $AB = 200\,mm$,$OC = 800\,mm$,$CD = 300\,mm$. (6)

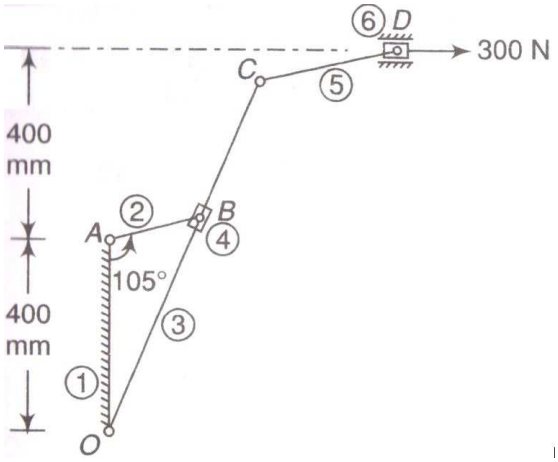

Figure 4:

OR

18. With the help of an example define the method of static force analysis with friction. (6)

19. With the help of neat sketches explain the procedure for dynamic analysis of a four bar mechanism. (6)

OR

20. Derive an expression for coupler curve for a four bar linkage. (6)