MECHANICAL ENGG. DEPT.

End Semester Examination. 14 Dec, 2006.

(BE- Mechanical Engg 2nd year)

ME-038 **Kinematics of Machines** Inst: AS Jawanda

Time: 3 Hr *Note: Attempt any 5 questions.* Max. Marks: 100

Answer all parts of a question together & sequentially Wt-age: 45 %

Q1 (a) What are the FIVE groups that machines can be divided into? Give example of each. 5

(b) Define the following terms:

1. Element
2. Link
3. Joint
4. Frame
5. Kinematic Chain
6. Instantaneous Centre
7. Correct Steering
8. Degree of Freedom
9. Cordal Action in chains
10. Crowning in belt drives

10

(c) Define 'Kinematically equivalent Mechanism'. Explain how the equivalent mechanism of an oscillatory follower and circular cam is obtained using neat sketches. 5

Q2 (a) Draw the coupler curve for a watts indicator mechanism, assume any mechanism size. Using Roberts Chebichev Theorem draw two cognate linkages which would generate the same curve 10

(b) Derive the condition for Grashof's law using near figures. Draw any example of a 4 bar chain and its inversions to show the proof of the law. 10

Q3 Synthesise a shaper mechanism with

i) Crank Radius = 7 cm running at 100 rpm c.w.

ii) Quick Return Ratio 1.5

iii) Stroke 30 cm.

iv) Connecting rod length 15 cm.

Find using relative velocity and acceleration diagrams when into 70% of return stroke:

1. Angular velocity of slotted link and connecting rod.
2. Rubbing velocity of pins on sliders with diameters of 3 cm.
3. Coriolis component of acceleration.
4. Velocity and Acceleration of tool.

20

Q4 (a) Using the Instantaneous Centre method, determine only the velocities for the mechanism in Q3 above. 10

(b) Derive the expression for the ratio os shaft velocities in a Hooke's joint. Determine the velocities for the driver and driven shafts and mark them on the polar plot for the speed comparison of them. 10

Q5 (a) Explain the term 'Correct Steering'. Prove that the Davis type of steering Gear is theoretically better than Ackermann type, by comparing the two. 5

(b) Plot the 'centorde' for an Ackermann steering Mechanism for a car with wheel track of 1.77m, distance between front stub axles is 1.47m, length of track rod fitted in front of the stub axle is 1.61m, wheel base is 3.3m, length of track arm is 20.5cm. Determine the turn radius for correct steering and mark the point on the 'centorde'. 15

Q6 (a) State the law of Belting. 2

Explain the condition for max power transmission for belt drive. 2

Draw neat diagrams to explain the uses of idlers in belt drives. 6

(b) A pulley of diameter 25cm is mounted on shaft A which rotates at 1400 rpm and drives a shaft B parallel to it at a distance of 3.5m at a speed reduced by 2.5 times. Allow for a 5% slip between belt and each pulley. Belt thickness 10mm.

It is desired that a shaft C in line with the axis of shaft A is to rotate at 2000 rpm to drive a grinding wheel. The direction of rotation of the grinding wheel is the same as shaft A. Determine the drive proportions so that interchangeable belts are used in drives A to B and B to C. 10

Q7 (a) What are the different types of friction and Mesh drives used? Using a neat chart and figures explain each type and its application. 10

(b) Draw the profile of a cam with knife edge follower which has SHM rise and a cycloidal motion during descent. Base radius of cam = 4cm, Angle of ascent and descent are 160 degree aech, dwell on base 40 degree, Lift 5cm. 10

Q8 (a) Using neat sketches show the classification of gears based on the relative position of axes, and the four types of gear trains 6

(b) What is the condition for correct gearing? Prove that involute teeth satisfy this condition. 4

(c) An epicyclic gear train is composed of a fixed annular wheel having 150 teeth. Meshing with A is a wheel B which drives wheel D through an idle wheel C, D being concentric with A. Wheels B and C are carried on an arm which revolves c.w. at 100 rpm about the axis of A and D. If the wheels B and D have 25 and 40 teeth respectively, find the number of teeth on C and the speed and sense of rotation of C. 10

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