SE (MECHANICAL & AUTOMOBILE) 2:30 to 5:30
SEM (IV) (CBSGS)
THEORY OF MACHINES-I

QP Code : 12464

(3 Hours) [**Total Marks : 80**

N.B. (1) Question No. 1 is **compulsory**.
(2) Attempt any **three** questions out of the remaining **five** questions.
(3) **Figures** to the **right** indicate **full** marks. ·
(4) Assume suitable **data** wherever required but justify the **same**.

1. Attempt any **four** of the following :— 20
   (a) What are the different types of kinematic pair ?
   (b) Classify cams in details.
   (c) State and explain D' Alemberts Principle.
   (d) What do you mean by interference in involute gears ?
   (e) Explain the terms slip and creep in belts.

2. (a) Sketch a polar velocity diagram of a Hooke's Joint and mark it's salient features. 8
   (b) A cam rotating at 150 rpm operates a reciprocating roller follower of radius 2·5 cm. 12
       The least radius of the cam is 5 cm and the stroke of the follower is 5 cm. Ascent
       and descent both takes place by uniform acceleration and retardation. Ascent takes
       place during 75° and descent during 90° of cam rotation. Dwell between ascent and
       descent is 60°. Sketch displacement. velocity and acceleration diagrams and mark
       salient features.

3. (a) What is a Pantograph? Show that it can produce paths exactly similar to the ones 8
       traced out by a point on a link on an enlarged or reduced scale.
   (b) In a mechanism shown in the figure, the crank OA is 100 mm long and rotates 12
       clockwise about O at 120 rpm. 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 (i) velocity
       of F, (ii) velocity of sliding of CE in the trunnion and (iii) angular velocity of CE.

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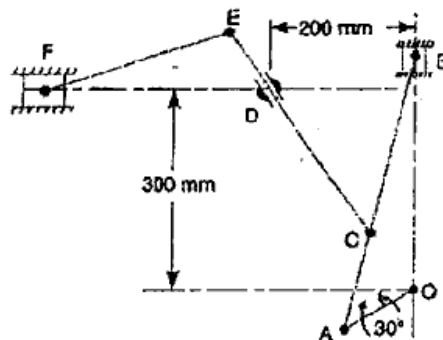
4. (a) With the help of neat sketch derive the equation for the minimum number of teeth on a pinion for involute rack in order to avoid interference.   **8**

    (b) Classify chains in details.   **6**

    (c) The power is transmitted from a pulley 1 m diameter running at 200 rpm to a pulley 2·25 m diameter by means of a belt. Find the speed lost by the driven pulley as a result of creep, if the stress on the tight and slack side of the belt is 1·4 MPa and 0·5 MPa respectively. The Young's Modulus for the material of the belt is 100 MPa.   **6**

5. (a) In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke. If the length of the slotted bar is 450 mm, find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever.   **8**

    (b) What do you mean by Coriolis component of acceleration ? Draw all the direction of Coriolis component of acceleration.   **6**

    (c) State and explain Work Energy principle with the help of an example.   **6**

6. (a) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. If addendum on each wheel is such that path of contact is maximum and interference is just avoided, find the path of contact, arc of contact and contact ratio. Also find the addendum for each wheel.   **8**

    (b) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1·95 m apart and are connected by cross belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rpm, if the maximum permissible tension in the belt is 1×10^3 N and the coefficient of friction between the belt and the pulley is 0·25 ?   **8**

    (c) Differentiate between involute and cycloidal gear tooth profile.   **4**