QP Code :NP-19749

(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) Assume **suitable** data wherever **necessary**.

1. Attempt any **four** :—   20
    (a) What do you mean by initial tension in belt drive ?
    (b) With the help of a simple four bar mechanism explain the types of instantaneous centres.
    (c) Explain the term pressure angle with respect to a cam mechanism. What are the methods to control it ?
    (d) Explain the types of constrained motions.
    (e) With the help of a neat sketch explain Grasshopper's mechanism.

2. (a) A cam with a minimum radius of 25 mm is to be designed for a knife edge follower   14
    with the following data :—
      (i) to raise the follower through 35 mm during 60° rotation of the cam.
      (ii) dwell for the next 40° of the cam rotation.
      (iii) descending of the follower during the next 90° of the cam rotation.
   (iv) dwell during the rest of the cam rotation.
    if the ascending and descending of the cam is with SHM and UARM respectively. Draw the displacement, velocity, acceleration and jerk diagram if the cam rotates at 150 rpm.

    (b) The universal coupling is used to connect two shafts together. The input shaft   6
    rotates at a uniform speed of 1200 rpm. Find the greatest permissible angle between the shaft axes so that the total fluctuation of speed may not exceed 200 rpm. Also find the maximum speed of driven shaft.

3. (a) The mechanism of a wrapping machine as shown in the **figure** has the following   14
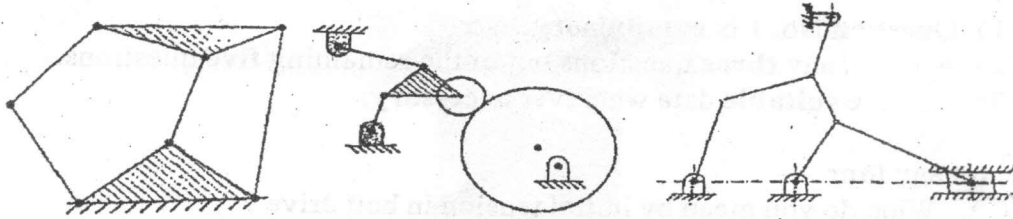   dimensions :—
    O_1A = 100 mm; AC = 700 mm; BC = 200 mm; O_3C = 200 mm; O_2E = 400 mm;
    O_2D = 200 mm and BD = 150 mm. The crank O_1A rotates at a uniform speed of 100 rad/s. Find the velocity of the point E of the bell crank lever by :
      (i) Instantaneous centre method.
      (ii) Relative velocity method.

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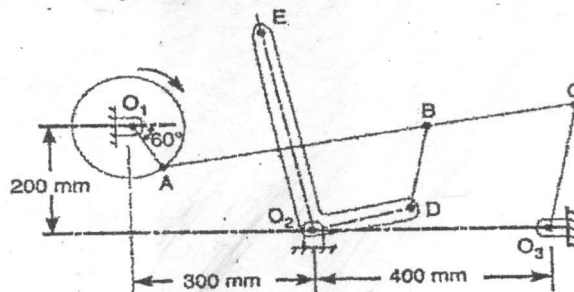
(b) Find the degree of freedom for the following mechanisms as shown in the **figure**,   6

4. (a) The centre to centre distance between the two sprockets of a chain drive is 600 mm.   7
The chain drive is used to reduce the speed from 180 rpm to 90 rpm. The driving
sprocket has 18 teeth and a pitch circle of 480 mm. Determine the number of
teeth on the driven sprocket, pitch and length of the chain.

(b) Two 20° involute spur gear mesh externally and give a velocity ratio of 3. Module   7
is 3 mm and the addendum is equal to 1.1 times module. If pinion rotates at 120 rpm
determine the number of pair of teeth in contact.

(c) Derive the equation for centrifugal tension with respect to belt drive. What is its   6
effect on power transmission ?

5. (a) A cord is wrapped around a solid cylinder of radius 'r' and mass 'm'. The cylinder   7
is released from rest. Determine the velocity of its centre of mass after it has
moved down a distance 'h'.

(b) With the help of a neat sketch explain law of gearing.   7

(c) What do you mean by Coriolois component of acceleration ? Draw its different   6
direction.

6. Differentiate between the following :—   20
       (a) Belt drive and chain drive.
       (b) Involute and cycloidal gear tooth profile.
       (c) Ackerman and Davis steering gear mechanism.
       (d) Machine and structure.

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