(3 hours)   Total Marks: 80

NB   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.

Q1.   **Attempt any four**   (20)

   A. What is Degree of freedom(DOF) of plane mechanism? Find DOF of single-slider crank
       mechanism using Kutzbach criteria.
   B. Explain with neat sketch the Watt's linkage for generating approximate straight line.
   C. What is instantaneous center of rotation? How to find number of instantaneous centers in
       a mechanism?
   D. State and derive law of Gearing.
   E. What is the effect of centrifugal tension on power transmitted in belt drive?

Q2   A. Two 20^0 involute spur gear have a module of 10 mm. The addendum is one module. The   (10)
         large gear has 50 teeth and pinion has 13 teeth. Does interference occur? If it occur, to
         what value the pressure angle be changed to eliminate interference?

   B. State and explain law of belting.   (5)

   C   What is self-locking and self-energised brake?   (5)

Q3   A. An open belt drive is required to transmit 10kW of power from a motor running at 600   (10)
         rpm. Diameter of driving pulley is 250 mm. The speed of driven pulley is 220 rpm. The
         belt is 12 mm thick and has mass density of 0.001 gm/mm^3. Safe stress in the belt is not
         to exceed 2.5 N/mm^2. The two shaft are 1.25 mm apart. The coefficient of friction is
         0.25 mm. Determine width of belt.

   B. A CAM is to give following motion to knife-edge follows: (10)
       i) To raise the follower through 30 mm with uniform acceleration and deceleration
          during 120^0 rotation of the CAM
       ii) Dwell for next 30^0 CAM rotation
       iii) To lower the follower with Simple Harmonic Motion during next 90^0 of CAM
          rotation
       iv) Dwell for rest of CAM rotation
   The CAM rotates in counter-clockwise direction with uniform speed of 800 rpm and has
   minimum radius of 30 mm. Find and draw maximum velocity and maximum
   acceleration during outward and return stroke.

Q4   A. The annulus A in the gear train shown in fig. 1 rotates at 300 rpm about the axis of the   (10)
         fixed wheel S which has 80 teeth. The three armed spider is driven at 180 rpm.
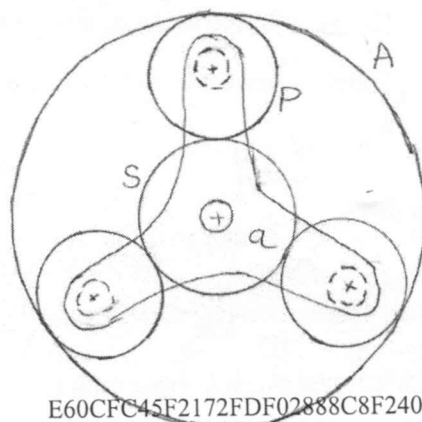   Determine the number of teeth required on wheel P.

Fig. 1 Gear Train

PTO

B. A wheel of mass 30 kg is pulled horizontally with force of 100 N applied through a cord (10) wrapped around inner drum of wheel as shown in fig 2. The wheel has radius of gyration of 75 mm, determine linear acceleration of mass center and angular acceleration of wheel. Consider μ_s=0.3 and μ_k=0.25.

70R   100R

100 N   (mm)

Fig.2
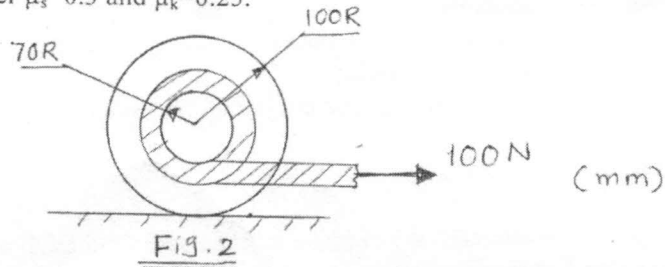
Q5   A. For the mechanism shown in fig. 3, has following dimensions: (14)
OA= 300 mm, AB=600 mm, AC=BD=1.2 m, OD is horizontal for given configuration.
If OA rotates at 200 rpm in clockwise direction, find the velocity of slider D By
    i) Relative velocity method
    ii) Instantaneous center method

30°   A   D   30°
O   E
B   (mm)
G   C
820
Fig 3
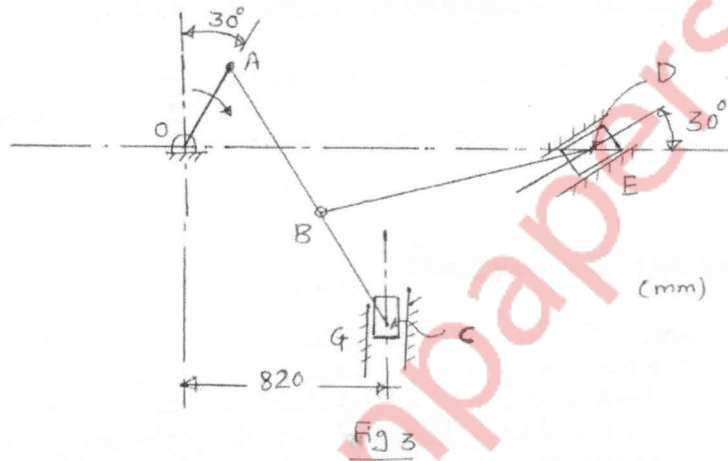
B. With neat sketch, explain the fundamental equation of steering gears for correct gearing. (06)

Q6   A. Fig. 4 shows a link mechanism of a quick-return mechanism of slotted-lever type. The (14) dimensions of links are as follows:
    OA=400 mm, OP=200 mm, AR=700 mm, RS=300 mm.
For the configuration shown, determine the acceleration of cutting tool S and angular acceleration of link RS. The crank OP rotates at 210 rpm.

S
R   G
350
P on slider
Q on AR   120°   O
(mm)
A   Fig.4
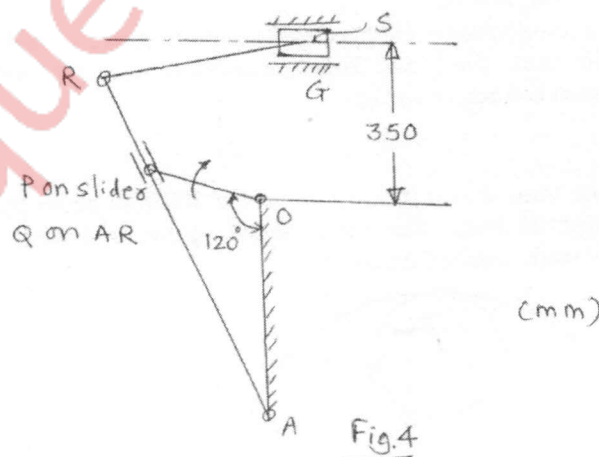
B. Explain chordal action in chain drive. (06)

═══XOX═══