

GUJARAT UNIVERSITY
B. E. Sem III (Mech./Auto.) (New) Examination
Kinematics

Saturday 29th December, 2007]

[Time : 3 Hours
 Max. Marks : 100

- Instructions :** (1) Attempt all questions.
 (2) Answer to the two sections must be written in separate answer books.
 (3) Assume suitable data if required.
 (4) Figures to the right indicate full marks.

SECTION - I

- 1 Use the following data in drawing the profile of a cam in which knife edged follower is raised with uniform acceleration and deceleration and is lowered with simple harmonic motion. : 16

- Least radius of cam = 60 mm,
 Lift of follower = 45 mm,
 Angle of ascent = 60° ,
 Angle of dwell between ascent and decent = 40° ,
 Angle of decent = 75° .

If the cam rotates at 180 r.p.m., determine the maximum velocity and acceleration during ascent and descent.

- 2 (a) Explain with the help of neat sketch differential gear of an automobile. 16
 (b) An epicyclic gear train is shown in Fig. 1. The number of teeth on A and B are 80 and 200. Determine the speed of the arm a :
 (i) If A rotates at 100 r.p.m. clockwise and B at 50 r.p.m. counter clockwise.
 (ii) If A rotates at 100 r.p.m. clockwise and B is stationary.

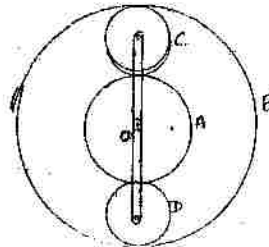


Fig. 1

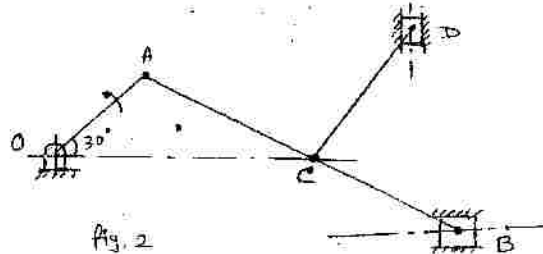
OR

- 2 (a) Find the expression for the screw efficiency of a square thread. Also determine the condition for maximum efficiency. 16
 (b) In a screw jack, the diameter of the threaded screw is 40 mm and the pitch 8 mm. The load is 20 kN and it does not rotate with the screw but is carried on a swivel head having a bearing diameter of 70 mm. The coefficient of friction between the swivel head and the spindle is 0.08 and between the screw and nut 0.1. Determine the total torque required to raise the load and the efficiency.
- 3 Attempt any three : 18
- (a) Describe various inversions of a slider crank mechanism giving examples.
 (b) Sketch a Paucelliar mechanism. Show that it can be used to trace a straight line.
 (c) Explain with the help of sketch ackermann steering gear mechanism.
 (d) What do you mean by degree of freedom of a kinematic pair ? How are pairs classified ?
 Give example.

P. T. O.

SECTION II

- 4 (a) The dimensions of the various lines of a mechanism, as shown in Fig. 2, are as follows : 16
 $OA = 80 \text{ mm}$; $AC = CB = CD = 120 \text{ mm}$.
 If the crank OA rotates at 150 r.p.m. in the anticlockwise direction, find for the given configuration : (i) velocity and acceleration of B and D ; (ii) Angular acceleration of lines AB and CD .



- 5 (a) Describe with the help of a neat sketch the principles of operation of an internal expanding shoe. Derive the expression for the braking torque. 16
 (b) A simple band brake is operated by a lever of length 500 mm. The brake drum has a diameter of 500 mm and brake band embraces $5/8$ of the circumference. One end of the band is attached to the fulcrum of the lever while the other end is attached to a pin on the lever 100 mm from the fulcrum of the lever while the other end is attached to a pin on the lever 100 mm from the fulcrum. If the effort applied to the end of the lever is 2 kN and the μ is 0.25, find the maximum braking torque on the drum.

OR

- 5 (a) Describe the construction and operation of a prony brake dynamometer. 16
 (b) In a band and block brake, the band is lined with 14 blocks, each of which subtends an angle of 20° at the drum centre. One end of the band is attached to the fulcrum of the brake lever and the other to a pin 150 mm from the fulcrum. Find the force required at the end of the lever 1 meter long from the fulcrum to give a torque of 4 kN-m. The diameter of the brake drum is 1 metre and the μ between the blocks and the drum is 0.25.
- 6 (a) Obtain an expression for the length of a belt in an open belt drive and a cross belt drive. 18
 (b) A flat belt, 8 mm thick and 100 mm wide transmits power between two pulleys, running at 1600 m/min. The mass of the belt is 0.9 kg/m length. The angle of lap in the smaller pulley is 165° and the coefficient of friction between the belt and pulley is 0.3. If the maximum permissible stress in the belt is 2 MN/m^2 , find : (1) maximum power transmitted, and (2) initial tension in the belt.

OR

- 6 (a) Explain the phenomena of 'Slip' and 'Creep' in a belt drive. 18
 (b) Explain the following : (1) Limiting friction (2) Angle of friction (3) Co-efficient of friction.
 (c) Explain with the help of neat sketch 'Sun and Planet wheel' ?