



- N.B. : (1) Question no. 1 is compulsory.
(2) Attempt any **three** questions out of remaining five.
(3) **Assume** suitable data, wherever necessary.

1. Attempt any four:-

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- (a) What is meant by inversion of a mechanism and explain any one inversion of slider crank mechanism.
(b) Distinguish between longitudinal, transverse and torsional vibrations.
(c) Locate all the instantaneous centres of slider crank mechanism shown in fig. 1

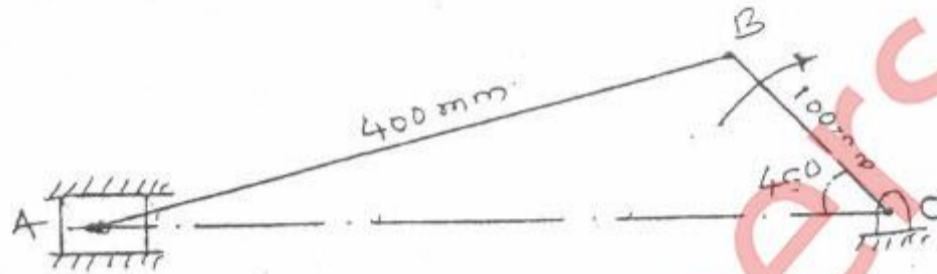


Fig.1

- (d) Sketch a Hart's mechanism, show that it can be used to trace a straight line path.
(e) For the kinematic linkage given below find total links, joints or pairs and degree of freedom: (Refer. fig.2)

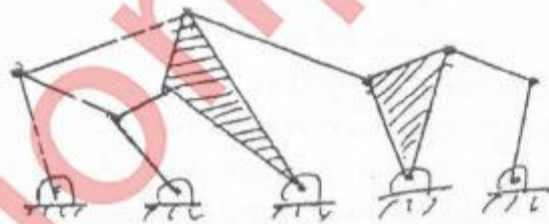


Fig. 2

2. (a) Define Coriolis acceleration component and derive its expression.

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- (b) Find the coriolis acceleration of slider 'D' and angular acceleration of link 'CD' for the engine mechanism shown in fig. 3. The crank 'OA' rotates uniformly at 180 rpm in clockwise direction. The various lengths are: OA = 150mm; AB = 450mm; PB = 240mm; BC = 210mm; CD = 660mm.

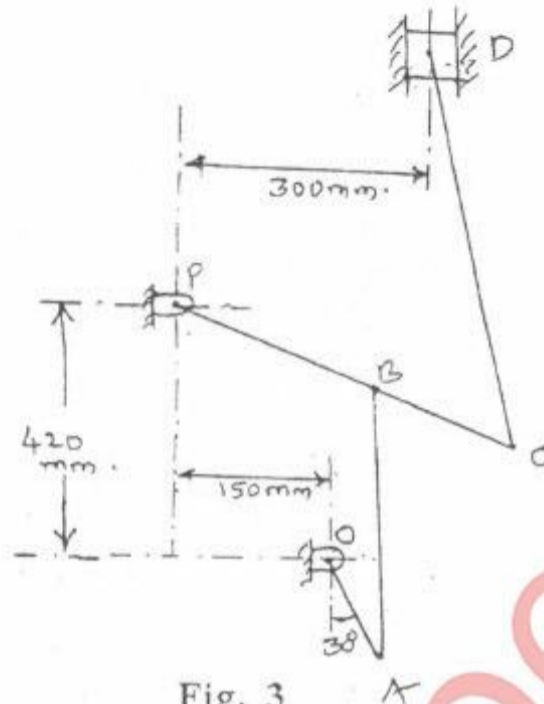


Fig. 3

3. (a) A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The outside diameter of the contact surfaces is 240mm and inside diameter is 120mm. Assuming uniform wear and coefficient of friction as 0.3, find the maximum axial intensity of pressure between the discs for transmitting 25kw at 1575 rpm? 10
- (b) A shaft 1.5m long, supported in flexible bearings at the ends carries two wheels each of 50kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375mm from the centre towards left. The shaft is hollow of external diameter 75mm and internal diameter 40mm. The density of shaft material is 7700 kg/m³ and its modulus of elasticity is 200GN/m³. Find the lowest whirling speed of the shaft, taking into account mass of shaft. 10
4. (a) A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18kg and 12.5kg respectively and each has an eccentricity of 60mm. The masses at A and D have an eccentricity of 80mm. The angle between the masses at B and C is 100° and that between masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100mm and that between B and C is 200mm. If shaft is in complete dynamic balance, Find: (1) Magnitude of masses at A and D; (2) Distance between planes A and D and (3) angular position of mass at D. 10

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- (b) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and gear ratio is 2. If the pitch expressed in module is 5mm and pitch line speed is 1.2m/s, assuming addendum as standard and equal to one module, find: 10
- The angle turned through by pinion when one pair of teeth is in mesh and
 - The maximum velocity of sliding.
5. (a) Describe the construction and operation of a rope brake dynamometer? 5
 (b) Explain law of gearing? 5
 (c) A band and block brake, having 14 blocks each of which subtends an angle of 15° at the centre, is applied to a drum of 1m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000kg and a combined radius of gyration of 500mm. The two ends of the band are attached to pins on opposite sides of the brake lever at distances of 30mm and 120mm from the fulcrum. If a force of 200N is applied at a distance of 750mm from the fulcrum, find: 10
- Maximum braking torque.
 - Angular retardation of the drum and
 - Time taken by the system to come to rest from the rated speed of 360rpm. Coefficient of friction between blocks and drum may be taken as 0.25.
6. (a) A cam is to give the following motion to a knife-edge follower: 15
- Out stroke during 60° of cam rotation.
 - Dwell for the next 30° of cam rotation
 - Return stroke during next 60° of cam rotation and
 - Dwell for the remaining 210° of cam rotation.
- The stroke of the follower is 40mm and minimum radius of the cam is 50mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when
- Axis of the follower passes through the axis of the cam shaft and
 - Axis of the follower is offset by 20mm from the axis of the cam shaft.
- (b) Briefly explain:- 5
- Swaying couple
 - Hammer blow