

NB: 1)Q.NO 1 is compulsory.

2)Attempt any three of remaining five questions.

3)Assume suitable data if required.

4)Figures to the right indicate full marks.



Q.1 Attempt any four

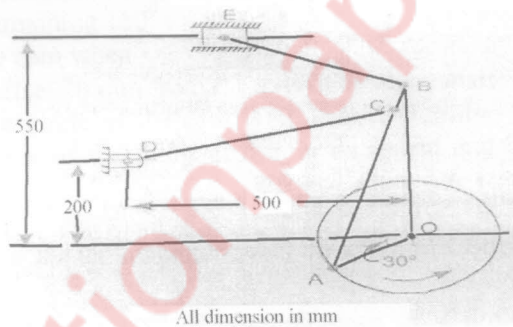
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- Explain classification of kinematics pairs.
- Discuss the types of instantaneous centres of rotation.
- classify Cams in detail.
- Explain law of gearing.
- Explain the term 'Whirling speed' or 'Critical speed; of a shaft.
- Explain Prony brake of dynamometer.

Q.2

a) Fig. shows the mechanism of a radical valve gear. The crank OA turns uniformly at 150 rpm and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as centre and DC as radius. The dimensions of various links are:  
 OA = 150 mm; AB = 550 mm; AC = 450 mm; DC = 500 mm; BE = 350mm.  
 Determine velocity and acceleration of the ram E for the given position of the mechanism.

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All dimension in mm

Q.3

- state and explain the inversions of single slider crank mechanism.
- A pair of involute spur gear with  $16^\circ$  pressure angle and pitch of module 6 mm is in mesh. The number of teeth on pinion is 16 and its rotational SPEED IS 240 rpm. When the gear ratio is 1.75 find in order that the interference is just avoided; 1. The addenda on pinion and gear wheel; 2. The length of path of contact; and 3. The maximum velocity of sliding of teeth on either side of the pitch point.
- A shaft 50 mm diameter and 3 meter long is simply supported at the ends and carries three loads of 1000 N, 1500 N and 750 N at 1 m, 2 m and 2.5 m from the left support. The Young's modulus for shaft material is  $200 \text{ GN/m}^2$ . Find the frequency of transverse vibration.

06

12

08

- Q.4 a) A conical friction clutch is used to transmit 90KW at 1500rpm. the semi cone angle is  $20^\circ$  and the coefficient of friction is 0.2. if the mean diameter of the bearing surface is 375mm and the intensity of the normal pressure is not to exceed  $0.25\text{N/mm}^2$ , find the dimensions of the conical bearing surface and the axial load required. 10

b) four masses A, B, C and D as shown below are to be completely balanced.

	A	B	C	D
Mass (kg)	--	30	50	40
Radius(mm)	180	240	120	150

The planes containing masses B and C are 300mm apart. the angle between planes containing B and C is  $90^\circ$ . B and C makes angles of  $210^\circ$  and  $120^\circ$  respectively with D in the same sense. Find

1. The magnitude and the angular position of mass A.
2. The position of planes A and D.

- Q.5 a) A cam is to be designed for a knife edge follower with the following data: 14
1. Cam lift = 40 mm during  $90^\circ$  of cam rotation with simple harmonic motion
  2. Dwell for the next  $30^\circ$ .
  3. During the next  $60^\circ$  of cam rotation, the follower returns to its original position with uniform acceleration and retardation.
  4. Dwell during the remaining  $180^\circ$ .

Draw the profile of the cam when

The line of stroke is offset 20 mm from the axis of the cam shaft.

The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 rpm.

b) Derive an expression for the magnitude and direction of Coriolis component of acceleration 06

- Q.6 a) A band brake acts on the  $3/4^{\text{th}}$  of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. one end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25. find the operating force when the drum rotates in the (a) anticlockwise direction and (b) clockwise direction. 10

b) In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D-E. The gear B meshed with gear E and the gear C meshes with gear D. The number of teeth on gear B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 rpm clockwise. 10