

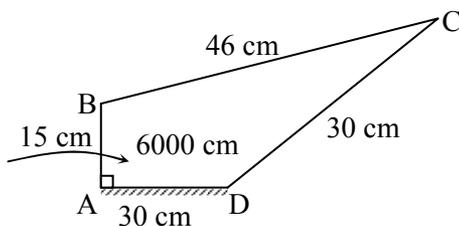
- Instructions :** (1) All Questions are compulsory.  
(2) Illustrate your answers with neat sketches wherever necessary.  
(3) Figures to the right indicate full marks.  
(4) Assume suitable data, if necessary.  
(5) Use of Non-Programmable Electronic Pocket Calculator is permissible.  
(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

1. Attempt any **TEN** of the following: [20]
- (a) Enlist the types of constrained motion. Draw a label sketch of any one.
  - (b) Define : (i) coefficient of fluctuation of speed  
(ii) coefficient of fluctuation of energy.
  - (c) Why is balancing of rotating parts necessary for high speed engines ?
  - (d) Define spherical pair. Also draw sketch.
  - (e) Explain terms : (i) Absolute velocity (ii) Relative velocity
  - (f) Define : (i) Pitch curve (ii) Prime circle
  - (g) Name different mechanisms generated from a single slider crank chain.
  - (h) State the advantages of roller follower over knife edge follower.
  - (i) Give four advantages of chain drive over belt drive.
  - (j) Define law of gearing.
  - (k) Define self-energizing and self-locking brake.
  - (l) What are the limitations of shoe brake?

2. Attempt any **FOUR** of the following: [16]
- (a) Draw a labelled sketch of Quick return mechanism of shaper and explain its working.

(b) What are the types of kinematic pair ? Give its examples.

(c) A Four bar chain mechanism ABCD with its dimensions is shown in Figure. It is driven by crank AB which rotated at 600 rpm in clockwise direction. The link 'AD' is fixed. Find the absolute velocity of point 'C' and angular velocity of links CB and CD.



- (d) What is machine? Differentiate between a machine and a structure.
- (e) A pulley is driven by the flat belt running at speed of 600 m/min. and transmit 4 kW. The coefficient of friction between belt and pulley is 0.3 and angle of lap is  $160^\circ$ . Find maximum tension in the belt.
- (f) Explain condition for maximum power transmission.

3. Attempt any **FOUR** of the following:

[16]

(a) In a slider crank mechanism, crank  $AB = 20$  mm & connecting rod  $BC = 80$  mm. Crank  $AB$  rotates with uniform speed of 1000 rpm in anticlockwise direction. Find :

- (i) Angular velocity of connecting rod  $BC$
- (ii) Velocity of slider  $C$ .

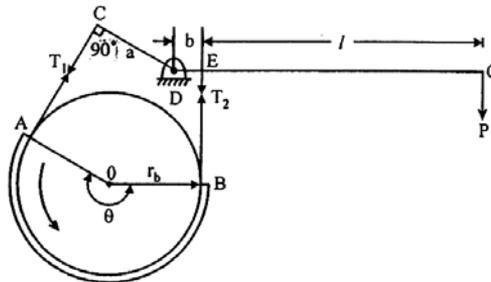
When crank  $AB$  makes an angle of 60 degrees with the horizontal. Draw the configuration diagram also. Use analytical method.

- (b) Draw a labelled sketch of multiplate clutch and state its applications.
- (c) Write the procedure of balancing single rotating mass when it balance mass is rotating in the same plane as that of disturbing mass.
- (d) A belt 20 cm wide, 0.8 cm thick transmits power to a pulley at a speed of 1000 m/min. If the density of leather belt is  $0.001 \text{ Kg/cm}^3$  and permissible pull in it is  $200 \text{ N/cm}^2$ . Calculate the power that can be transmitted at this speed, the tension on tight side is twice of the tension on the slack side.
- (e) Discuss the following motion of the follower by drawing the displacement velocity and acceleration motion diagram.
  - (i) Uniform Velocity
  - (ii) Simple Harmonic Motion
  - (iii) Uniform acceleration and retardation
- (f) Explain the working of Watt governor with neat diagram.

4. Attempt any **FOUR** of the following:

[16]

- (a) Justify with neat sketch elliptical trammel as an inversion of double slider crank chain.
- (b) Differentiate between flywheel and governor.
- (c) A band brake of belt type is as shown in figure. The brake drum diameter is 40 cm and the system is used on a winding drum of crank requiring a brake torque 1500 N-m. Two ends of the band are attached to the pins on the opposite sides of the fulcrum of the break lever at distance of 10 cm and 2 cm. The coefficient of friction is 0.3, angle of contact  $225^\circ$  and the lever length is 60 cm. Find the effort required at the end of the lever.



- (d) Explain the working of internal expanding shoe brake with the help of a neat sketch.
- (e) Explain the working of freewheel mechanism of bicycle with sketch.
- (f) A shaft has number of collars integral with it. The external diameter of the

collars is 400 mm and the shaft diameter is 250 mm. If the uniform intensity of pressure is  $0.35 \text{ N/mm}^2$  and its co-efficient of friction is 0.05; find :

- (i) power absorbed in overcoming friction when shaft rotates at 105 rpm and carries a load of 150 kN, and (ii) number of collars required.

5. Attempt any **TWO** of the following:

[16]

- (a) Draw the profile of cam operating a roller reciprocating follower with the following data :

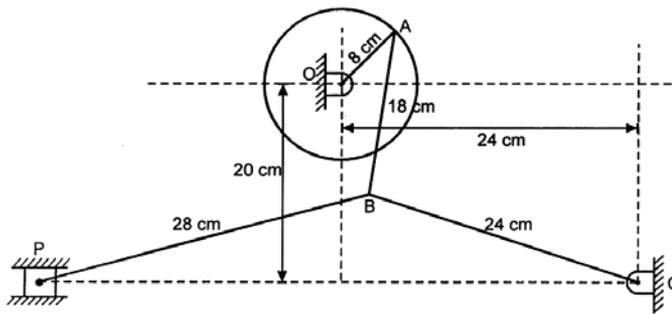
Minimum radius of cam = 25 mm

lift = 30 mm

Roller diameter = 15 mm

The cam lifts the follower for  $120^\circ$  with SHM followed by a dwell period of  $30^\circ$ . Then the follower lowers down during  $150^\circ$  of the cam rotation with uniform acceleration and deceleration followed by a dwell period.

- (b) Give causes of vibrations. What are the disadvantages and advantages of vibration?
- (c) Figure shows the toggle mechanism in which the crank 'OA' rotated at a uniform speed of 105 r.p.m. in clockwise direction. Determine the velocity and acceleration of slider 'P'. The lengths of various links are : OA = 8 cm, AB = 18 cm, BC = 24 cm and BP = 28 cm.



6. Attempt any **TWO** of the following:

[16]

- (a) (i) Explain slip and creep phenomenon in belts.  
 (ii) Explain single cylinder 4-stroke I.C. engine using turning moment diagram.
- (b) (i) Define the following terms as applied to cam with neat sketch.  
 (1) Pitch circle (2) Pressure angle  
 (3) Stroke of follower (4) Module  
 (ii) Differentiate between disc brake and internally expanding brake.
- (c) Explain the working of rope brake dynamometer with neat sketch.

