Vidyalankar

S.Y. Diploma : Sem. IV [AE/ME/MH/MI/PG/PT]

Theory of Machines

Time: 3 Hrs.]   Prelim Question Paper   [Marks : 100

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) Preferably, write the answers in sequential order.

1. (a) Attempt any **SIX** of the following: **[12]**
   (i)   Define spherical pair. Also draw sketch.
   (ii)   Define kinematic link with two examples.
   (iii) Explain terms :
          1) Absolute velocity   2) Relative velocity
   (iv)   Define :
          1) Pitch curve   2) Prime circle
   (v)   Draw the types of belt.
   (vi)   Draw sketch of open belt drives and cross belt drives.
   (vii) Sketch neat labelled diagram of Porter Governor.
   (viii) Explain concept of self-locking and self-energizing of Brakes.

   (b) Attempt any **TWO** of the following: **[8]**
   (i)   Difference between Machine and mechanism.
   (ii)   Explain inversions of a single slider crank chain mechanism.
   (iii) Explain with neat sketch of Scotch-Yoke mechanism.

2. Attempt any **FOUR** of the following: **[16]**
   (a) Explain sprocket Mechanism of bicycle with labelled drawing.
   (b) Explain working of Ackerman's steering gear mechanism.
   (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.
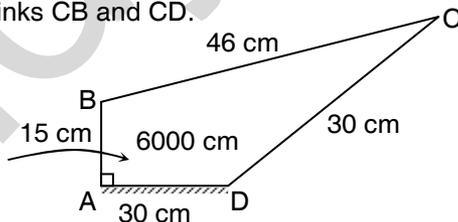
   (d) Explain the types of followers.
   (e) Explain "Creep in belt".
   (f) Explain the centrifugal tension.

3. Attempt any **FOUR** of the following: [16]
   (a) Comparison between flat belt drive and V-belt drive.
   (b) 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 Kg/cm^3 and permissible pull in it is 200 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.
   (c) Find power transmitted by belt running over a pulley of 60 mm diameter at 200 rpm. The coefficient of friction between belt and pulley is 0.25 and angle of lap is 180°. Take maximum tension in belt equal to 2500 N.
   (d) Explain turning moment diagram of an internal combustion engine.
   (e) Differentiate between flywheel and governor.
   (f) Explain with neat sketch Hartnell governor.

4. Attempt any **FOUR** of the following: [16]
   (a) Give classification tree of brakes.
   (b) 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° and the lever length is 60 cm. Find the effort required at the end of the lever.
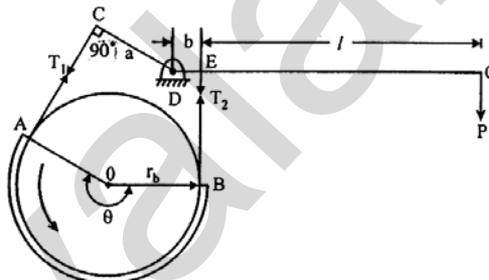
   (c) Explain by neat sketch of internal expansion shoe brakes.
   (d) Explain working procedure of multiple plate clutch system.
   (e) If the power lost in friction of coller thrust bearings rotating at 150 r.p.m. carrying an end trust of 50 kN, having an outside radius of 25 cm and inner radius of 15 cm, it not to exceed 2 kW. What should be the coefficient of friction fo the lubricant?
   (f) Define : (i) Free vibration   (ii) Forced vibration
               (iii) Natural frequency   (iv) Degree of freedom

5. Attempt any **TWO** of the following: [16]
   (a) Give causes of vibrations. What are the disadvantages and advantages of vibration?
   (b) The crank of a reciprocating engine is 10 cm long and it rotated at a uniform speed of 20 radius clockwise. The connecting rod length is 40 cm. Determine the velocity and acceleration of the Piston and angular velocity and angular acceleration of the connecting rod when the crank is at 0°, 45°, 90° and 135° from i.d.c.

(c) Figure shows the toggle mechanism in which the crank 'OA' rotated at a uniform spand of 105 r.p.m. in clockwise direction. Determine the velocity and acceleration of sliter 'P'. The lengths of various links are : OA = 8 cm, AB = 18 cm, BC = 24 cm and BP = 28 cm.
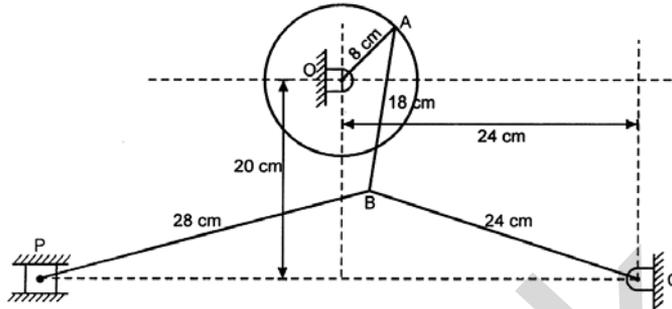
6. Attempt any **TWO** of the following: **[16]**

(a) A cam operated a roller in line reciprocating follower :
The further specifications case

minimum radius of cam = 25 mm	Lift of follower = 30 mm
diameter of roller = 15 mm	angle of lift = 120°
(Nature of lift is S.H.M.)	
Outer dwell angle = 30°	Angle of return = 150°

Nature of return is uniform acceleration and retardation where acceleration is equal to retardation in magnitude)

(b) Derive the condition for maximum power transmission by a belt.

(c) A multiple clutch has three pairs of contact surfaces. The outer and inner radii of contact surfaced are 100 mm and 50 mm respectively. The maximum axial spring force is limited to 1 kN. If the coefficient of friction is 0.35 and assuming uniform wear. Find the power transmitted by clutch at 1500 r.p.m.

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