11920

3 Hours / 100 Marks   Seat No. ☐☐☐☐☐☐☐☐

Instructions :   (1)   All Questions are *compulsory.*

(2)   Answer each next main Question on a new page.

(3)   Illustrate your answers with neat sketches wherever necessary.

(4)   Figures to the right indicate full marks.

(5)   Assume suitable data, if necessary.

(6)   Use of Non-programmable Electronic Pocket Calculator is permissible.

(7)   Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1.   **(A)   Attempt any SIX of the following :**   **2 × 6 = 12**

(a)   Define mechanism. State any one example of mechanism.

(b)   Define machine and structure.

(c)   Define fluctuation of energy and coefficient of fluctuation of energy.

(d)   Define Slip & Creep in case of belt drive.

    (e)   State the function of flywheel in an I.C. engine.

    (f)   Explain the concept of balancing.

    (g)   Define Pitch curve and Prime circle w.r.t. cams.

    (h)   State the function of brake and dynamometer.

(B)   Attempt any TWO of the following :   **2 × 4 = 8**

    (a)   Distinguish between mechanism and machine.

    (b)   A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 rpm, assuming : (i) Uniform pressure; and (ii) Uniform wear.

    (c)   State the advantages of V-belt drive over flat belt drive.

2.   Attempt any FOUR of the following :   **4 × 4 = 16**

    (a)   Define inversion. Explain the various inversions of double slider crank chain mechanism.

(b) Define Kinematic pair. Explain the various types of constrained motions with the help of neat sketches.

(c) Explain the procedure for construction of Klein's velocity and acceleration diagrams for a single slider crank chain mechanism. Use suitable data.

(d) In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise, while the link CD, 80 mm long, oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°.

(e) State four types of followers according to the surface in contact with the cam. Draw respective sketches.

(f) An engine, running at 150 rpm, drives a line shaft by means of a belt. The engine pulley is 750 mm diameter & the pulley on the line shaft being 450 mm. A 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Find the speed of the dynamo shaft,when : (1) there is no slip, and (2) there is a slip of 2% at each drive.

3. **Attempt any FOUR of the following :** 4 × 4 = 16

(a) The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 rpm in clockwise direction. When it has turned 45° from the inner dead centre position, determine : (1) Velocity of piston, (2) Angular velocity of connecting rod, (3) Velocity of point E on the connecting rod 1.5 m from the gudgeon pin.

    (b)   In fig. (a), the angular velocity of the crank OA is 600 rpm. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are : OA = 28 mm; AB = 44 mm; BC = 49 mm; and BD = 46 mm. The centre distance between the centres of rotation O & C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical.
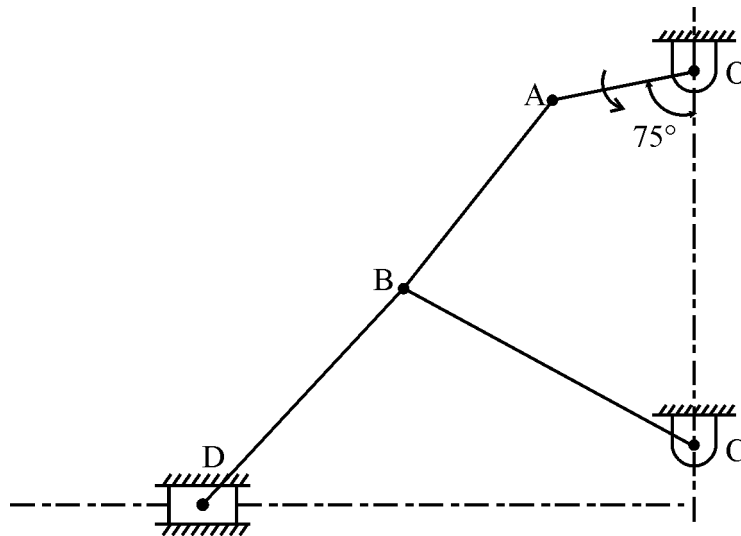

Fig. (a)

    (c)   Discuss with sketch the working principle of reverted gear train.

    (d)   Explain with neat sketch the construction and working of multiplate clutch.

    (e)   Explain the process of balancing a single rotating mass when balancing masses are on the opposite side of disturbing mass.

    (f)   State any four applications of cam.

4. **Attempt any FOUR of the following :** **4 × 4 = 16**

(a) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160° and maximum tension in the belt is 2500 N.

(b) Explain with neat sketch the construction and working of beam engine.

(c) Explain the construction and working of centrifugal governor with the help of neat sketch.

(d) Differentiate between brakes and dynamometers.

(e) A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm^2. If the coefficient of friction is 0.3, determine the power transmitted by clutch at a speed of 2500 rpm.

(f) Four masses are 200 kg, 300 kg, 240 kg and 260 kg. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively. The angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of balance mass required, if its radius of rotation is 0.2 m. Use graphical method.

P.T.O.

5. **Attempt any TWO of the following :** 2 × 8 = 16

(a) PQRS is a four bar chain with link PS fixed. The lengths of the links PQ, QR, RS & PS are 62.5 mm, 175 mm, 112.5 mm and 200 mm respectively. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q & R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR & RS.

(b) A cam is to give the following motion to a knife-edged follower :
(1) Outstroke during 60° of cam rotation; (2) Dwell for the next 30° of cam rotation; (3) Return stroke during next 60° of cam rotation, and (4) Dwell for remaining 210 of cam rotation. The lift of follower is 40 mm and the minimum radius of cam is 50 mm. The follower moves with uniform velocity during outstroke and with uniform acceleration and retardation during return stroke. Draw the profile of cam when the axis of follower passes through the axis of cam shaft.

(c) Two pulleys of 450 mm and 200 mm diameter are mounted on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of belt required and the angle of contact between belt and each pulley. What power can be transmitted by the belt when larger pulley rotates at 200 rpm, if maximum permissible tension in the belt is 1 kN and coefficient of friction between the belt & pulley is 0.25 ?

6. **Attempt any TWO of the following :** 2 × 8 = 16

    (a) (i) Differentiate between flywheel and governor.

          (ii) Explain the turning moment diagram for single cylinder 4-stroke I.C. engine.

    (b) A band brake acts on the 3/4th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 Nm. 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) anti-clockwise direction, and (b) clockwise direction.

    (c) A conical pivot supports a load of 20 kN, the cone angle is 120° and the intensity of normal pressure is not to exceed 0.3 N/mm^2. The external diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 rpm and the coefficient of friction is 0.1, find the power absorbed in friction. Assume uniform pressure.

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