**21222**

**3 Hours / 70 Marks**          Seat No.

15 minutes extra for each hour

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***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.

**Marks**

1.   **Attempt any FIVE of the following :**          **10**

(a)   List the inversion of double slider crank mechanism.

(b)   Define kinematic link and kinematic chain.

(c)   Define centripetal and tangential acceleration.

(d)   State the application of cam.

(e)   Define following terms with respect to cam and follower :

(i)    Prime circle

(ii)   Pitch circle

(iii)  Pressure angle

(iv)   Trace point

(f)   Define Self-energizing and Self-locking brake.

(g)   State effect of imbalance in machine.

**2. Attempt any THREE of the following :** **12**

(a) Define completely constrained motion and successfully constrained motion with neat sketch. State one example of each.

(b) The central distance between two shaft is 4 m having two pulleys with diameter having 500 mm and 700 mm respectively. Find the length of belt required

    (i) For open belt drive

    (ii) For cross belt drive

(c) Discuss the following motion of the follower by drawing the displacement diagram :

    (i) Simple Harmonic Motion

    (ii) Uniform acceleration and retardation

(d) Describe the construction and working of Epicyclical gear train with neat sketch.

**3. Attempt any THREE of the following :** **12**

(a) Explain the mechanism and working principle of Oldham's coupling.

(b) Describe with sketch the working of a crank and slotted lever quick return mechanism.

(c) Explain the principle of working of Internal expanding brake.

(d) Draw a sketch of radial cam with roller follower and show the following on it :

    (i) Pitch point

    (ii) Pressure angle

    (iii) Prime circle

    (iv) Trace point

(e) Write the procedure for balancing of a single rotating mass by single masses rotating in the same plane.

**4.** **Attempt any TWO of the following :** 12

(a) Justify that slider crank mechanism is a modification of the basic four bar mechanism with neat sketch.

(b) In a four-bar mechanism, the crank AB rotates at 36 rad/sec. The lengths of a links are AB = 200 mm, BC = 400 mm, CD = 450 mm and AD = 600 mm. AD is the fixed link. At the instant when AB is a right angle to AD, determine the velocity of (i) The midpoint of the link BC (ii) A point on the link CD, 100 mm from the pin connecting the link CD & AD.

(c) A cam is to be designed for a knife edge follower with the following data :

   (i) Cam lift = 40 mm during 90º of cam rotation with SHM.

   (ii) Dwell for the next 30º

   (iii) During the next 60º of cam rotation, the follower returns to its original position with SHM.

   (iv) Dwell during the remaining 180º.

   Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

**5.** **Attempt any TWO of the following :** 12

(a) (i) Define 'Gear Train', state its purpose and types of gear train.

   (ii) Explain the phenomenon of slip and creep in a belt drive.

(b) Explain Klein's construction to determine velocity and acceleration of link in an IC engine.

(c) Explain with sketch construction and working of Centrifugal Governor.

6.    **Attempt any TWO of the following :**                                    12

    (a)    A belt is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density 0.001 gm/mm$^3$, safe stress in the belt is not to exceed 2.5 N/mm$^2$, diameter of the driving pulley is 250 mm whereas the sped of the driven pulley is 200 rpm. The two shafts are 1.25 M apart. The coefficient of friction is 0.25, determine,

        (i)    Angle of contact at driving pulley

        (ii)    The width of the belt

    (b)    Explain with sketch construction and working of centrifugal clutch.

    (c)    Draw turning moment diagram for single cylinder four stroke IC engine. Label all parts.

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