**21222**

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

15 minutes extra for each hour

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

**Marks**

1.     **Attempt any FIVE of the following :**                                              **12**

(a)   Define : (i) Kinematic link (ii) Kinematic pair.

(b)   Name any two mechanisms used to convert rotary motion into reciprocating motion.

(c)   State the inter-relation between linear velocity and angular velocity.

(d)   Name the four motions by which follower moves, during its applications.

(e)   State the applications of roller follower and flat faced follower.

(f)   State how the function of a brake is different than clutch.

(g)   Define : (i) Height of governor (ii) Equilibrium speed of governor.

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

    (a) Draw a neat sketch of Elliptical trammel, and explain its working principle.

    (b) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The co-efficient of friction between the belt and the pulley is 0.25, angle of lap is 165°, and maximum tension in the belt is 2550 N.

    (c) Draw the schematics of the following :

        (i) Cam with knife edge follower

        (ii) Cam with roller follower

        (iii) Cam with flat faced follower

        (iv) Cam with spherical faced follower.

    (d) Explain how the velocity ratio of epicyclic gear train is obtained by tabular method.

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

    (a) Draw a need sketch of pantograph and explain its working.

    (b) Draw a neat sketch of the mechanism used in shaper machine, to achieve the quick return stroke.

    (c) Explain the working principle of centrifugal clutch, using neat sketch.

    (d) For high speed applications, roller follower is preferred over knife edge follower. State true or false and justify your answer.

    (e) Define the term co-efficient of fluctuation of speed, and co-efficient of fluctuation of energy as applied to flywheel. State their significance.

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

    (a) Draw a neat sketch of oscillating cylinder engine and explain its construction.

    (b) In the engine mechanism, crank OB = 50 mm, length of connecting rod = 225 mm. The centre of gravity of the rod is at 'G' which is 75 mm from 'B'. The speed is 200 rpm, and the crank OB is rotated at 45° from 'OA'. Find out the velocity of point 'G' and angular velocity of AB by relative velocity method.

(c) A disc cam rotating in a clockwise direction is used to move a reciprocating roller with simple Harmonic Motion in a radial path, as given below

(i) Outstroke with maxi. displacement of 25 mm during 120° of cam rotation

(ii) Dwell for 60° of cam rotation

(iii) Return stroke with maxi displacement of 25 mm during 90° of cam rotation, and dwell for remaining period.

Draw the cam profile, when the maximum cam radius is 20 mm. Take roller dia. meter as 8 mm.

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

(a) Applying the knowledge of selection of drive for power transmission, select the suitable drive for following applications. Also justify your selection.

(i) Electric Two Wheeler (Battery operated)

(ii) Flour Mill

(iii) JCB (Heavy earth moving machine)

(iv) Wrist watch (Analog)

(v) Stone crusher

(vi) Road Roller

(b) In a slider crank mechanism, the length of crank and connecting rod are 200 mm and 800 mm respectively. The crank position is at the 60° from I.D.C. The crank rotates at a speed of 500 rpm (clockwise). Using analytical method, determine the velocity and acceleration of slider.

(c) Four masses A, B, C & D are attached to the shaft and revolve in the same plane. The masses are 12 kg, 15 kg, 18 kg, & 20 kg respectively and their radii of rotation are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135° and 270° from mass A. Find the magnitude and position of the balancing mass at radius of 100 mm.

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

(a) State the need of chain lubrication and explain various methods of chain lubrication.

(b) A band brake acts on ¾ᵗʰ of the 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 other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the co-efficient of friction is 0.25 find the operating force when the drum rotates in the anti-clockwise direction.

(c) Using neat sketch explain the working of centrifugal governors.

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