23242

3 Hours / 70 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.

Marks

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

(a)   Sketch the 'Geneva Mechanism' and identify the kinematic chain to which it belongs.

(b)   A crank and slotted lever mechanisms used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke.

(c)   Define the term linear and angular velocity.

(d)   What do you understand by "Initial Tension" in a belt ?

(e)   Define the following gear terminology :

(i)   Module

(ii)   Pressure angle

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

(g)   Define the following terms related to governor :

(i)   Sensitiveness

(ii)   Hunting

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

(a) With the help of neat sketch, describe the working of an "Elliptical Trammel".

(b) In a slider crank mechanism, the crank rotates uniformly, at 800 rpm in clockwise. The length of connecting rod are 600 mm and crank of 300 mm. Find the velocity and acceleration of the connecting rod, if the crank has turned through 45° from IDC. (Note : use analytical method)

(c) Explain the following terms as applied to cam with suitable sketch :

(i) Base circle

(ii) Stroke of follower

(iii) Prime circle

(iv) Pitch circle

(d) State the significance of "Tight and Slack Side" in belt drive. Generally the lower side is kept tight side and upper side is kept as slack side with the belt drives having small driving pulley and big driven pulley. State the reason behind it.

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

(a) Identify and enlist the types of kinematic pairs used in following with appropriate applications :

(i) Lead screw

(ii) Ball & socket joint

(iii) Shafts with collars at both ends fitted in circular holes

(iv) Toothed gearing

(b) Draw the velocity polygon with its procedure for single slider crank mechanism by using Klein's construction.

(c) State any two advantages of roller follower over knife edge follower. Also draw the labelled displacement and velocity diagram for a follower moves with uniform velocity.

(d) Two parallel shafts whose centre line are 4.8 m apart, are connected by open belt drive. The diameter of the larger pulley is 1.5 m and that of smaller pulley is 1 m. The initial tension in the belt when stationary is 3 kN. The mass of the belt is 1.5 kg/m length. The coefficient of friction between the belt and pulley is 0.3. Calculate the power transmitted when the smaller pulley rotates at 400 rpm.

4. Attempt any THREE of the following : 12

(a) Differentiate between completely constrained and successfully constrained motion with respect to following parameters :

(i) Concept (Definition) with suitable examples.

(ii) Suitable sketch of each.

(b) Define the "Rubbing Velocity at a pin joint". What will be the rubbing velocity at pin joint, when the two links move in the same and opposite directions ?

(c) Draw the displacement diagrams for a follower when it moves with :

(i) Simple Harmonic Motion

(ii) Uniform Acceleration and Retardation

(d) Explain the construction of "Reverted Gear Train" with power flow diagram.

5. Attempt any TWO of the following : 12

(a) Explain the following mechanisms with respect to the parameters viz. type of kinematic chain, suitable labelled sketch and applications :

(i) Coupling rod of locomotives

(ii) Pendulum pump

(b) An engine running at 150 rpm, drives a line shaft by means of a belt. The engine pulley is 750 mm diameter and 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 (i) There is no slip. (ii) There is a slip of 2% at each drive line. (iii) Also state the effect of slip on velocity ratio.

(c) Explain with neat sketch, construction and working of "Internal Expanding Shoe Brake".

6. Attempt any TWO of the following : 12

(a) A cam is to give the following motion to a knife edge follower :

(i) Outstroke during 60° of cam rotation with SHM.

(ii) Dwell for next 30° of cam rotation.

(iii) Return stroke during next 60° of cam rotation with uniform velocity.

(iv) Dwell for the remaining 210° of cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. Draw the profile of cam when the axis of the follower passes through the axis of the camshaft.

(b) A car engine has its rated output 12 kW. The maximum torque developed is 100 N-m. The clutch used is of single plate type having two active surfaces. The axial pressure is not to exceed 85 kN/m^2. The external diameter of friction plate is 1.25 times the internal diameter. Assume coefficient of friction is 0.3. Determine :

(i) The dimensions of internal and external dia. of friction plate.

(ii) Axial force exerted by the springs.

(c) The four masses M1, M2, M3 & M4 are 150 kg, 200 kg, 250 kg and 210 kg respectively. The corresponding radii of rotations are 15 cm, 10 cm, 20 cm and 25 cm and the corresponding angles are 10°, 60°, 130° & 245° respectively. Find the position and magnitude of balance mass analytically and graphically, if the radius of rotation is 18 cm.

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