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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.

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

a) Define kinematic link and kinematic chain.

b) Define sliding pair with example.

c) List the inversions for double slider crank mechanism.

d) Define :

i) Linear velocity

ii) Absolute velocity

e) State the types of chains and sprockets.

f) Why is balancing of rotating parts necessary for high speed engines ?

g) State two methods of balancing of single rotating masses.

P.T.O.

Marks

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

a) Explain pantograph with neat sketch.

b) Draw the labelled sketch of Quick Return mechanism of shaper and explain its working.

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

d) Compare cross belt drive and open belt drive on the basis of :

i) Velocity ratio

ii) Application

iii) Direction of driven Pulley

iv) Length of BELT drive.

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

a) Draw the schematics of following

i) Cam with knife edge follower.

ii) Cam with roller follower.

iii) Cam with flat faced follower.

iv) Cam with spherical faced follower.

b) Explain with neat sketch working principle of epicyclic gear train.

c) Write the procedure for balancing of single rotating mass by single mass rotating in the same plane.

d) Justify with neat sketch, elliptical trammel as an inversion of double slider crank chain.

Marks

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

a) Write the classification of cams. Draw a sketch of any one.

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

c) What is centrifugal tension ? State its formula. Explain its effect on power transmitted by a belt drive.

d) State advantages and disadvantages of vibration.

e) Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotation are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of masses B, C and D are 60°, 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm. Use graphical method only.

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

a) Defined constrained motion and explain its types with neat sketch.

b) In slider crank mechanism, length of crank and connecting rod are 100 mm and 400 mm respectively. The crank rotates uniformly at 600 rpm clockwise. When the crank has turned through 45° from IDC Find analytically :

i) Velocity and acceleration of slider

ii) Angular velocity and angular acceleration of connecting rod.

c) Two pulleys one 700 mm diameter and the other 500 mm diameter are mounted on parallel shafts 4 m apart and are connected by a belt drive. Find the length of the belt required :

i) For open belt drive

ii) For cross belt drive.

Marks

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

a) In four bar chain ABCD, link 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 $\angle BAD = 60°$

b) Draw the profile of cam imparting motion to a roller follower with following details :

Stroke length = 42 mm, Roller diameter = 14 mm, Base circle diameter = 60 mm, Angle of rise = 120°, Dwell after rise = 60°, Angle of return = 180°. The follower rises with SHM and returns with uniform velocity.

c) Draw the profile of cam to raise a valve with SHM through 40 mm in $\left(\frac{1}{4}\right)^{th}$ of revolution keep it fully raised through $\left(\frac{1}{10}\right)^{th}$ revolution and to lower it with uniform acceleration and retardation in $\left(\frac{1}{6}\right)^{th}$ revolution. The valve remains closed during the rest of the revolution. The diameter of roller is 20 mm and minimum radius of cam to be 30 mm. The axis of the valve rod passes through the axis of cam shaft.

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