

17972

16117

3 Hours / 100 Marks

Seat No.

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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. (A) Attempt any SIX :

12

- (a) Define :
 - (i) lower pair
 - (ii) Higher pair
- (b) Enlist different types of motion of follower.
- (c) What do you mean by crowning of pulleys in flat belt drive ? State its use.
- (d) What is the necessity of clutch ?
- (e) Define fluctuation of speed and fluctuation of energy in case of flywheel.
- (f) Define stability and hunting of governor.
- (g) State types of brakes.
- (h) State reasons of balancing of rotating elements of machine.

(B) Attempt any TWO :

8

- (a) State any four inversions of single slider crank chain. Describe any one with neat sketch.
- (b) State one application of each :
 - (i) V-belt drive
 - (ii) Flat belt drive
 - (iii) Gear drive
 - (iv) Chain drive
- (c) Explain working of hydraulic brake.

2. Attempt any FOUR :**16**

- (a) Differentiate between machine and structure.
- (b) Explain Rotary I.C. engine mechanism.
- (c) State the formula for calculating
 - (i) Velocity
 - (ii) Acceleration of piston and connecting rod using analytical method.
- (d) Explain the Klein's construction to determine velocity and acceleration of a link in an I.C. engine mechanism.
- (e) Explain with neat sketch of elliptical trammel.
- (f) In a flat belt drive the initial tension is 2000 N. The coefficient of friction between the belt and the pulley is 0.3 and the angle of lap on the smaller pulley is 150° . The smaller pulley has a radius of 200 mm and rotates at 500 r.p.m. Find the power in kW transmitted by the belt

3. Attempt any FOUR :**16**

- (a) In a four-link mechanism, the crank AB rotates at 36 rad/sec. The lengths of link 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 right angles to AD, determine the velocity of :
 - (i) The midpoint of link BC.
 - (ii) A point on the link CD, 100 mm from the pin connecting the link CD and AD.
- (b) In a slider crank mechanism, the length of crank OB and connecting rod AB are 125 mm and 500 mm respectively. The crank speed is 600 rpm clockwise. When the crank has turned 45° from the inner dead centre position, determine
 - (i) Velocity of slider 'A'
 - (ii) Draw the configuration diagram also.
- (c) State types of gear train and explain any one.
- (d) Draw a neat labelled sketch of single plate clutch and state its working.
- (e) Explain the method of balancing of different masses revolving in the same plane.
- (f) Draw different types of cams.

4. Attempt any FOUR :**16**

- (a) Draw a neat labelled sketch of spur gear terminology.
- (b) Explain with neat sketch Oldham's coupling.
- (c) Compare flywheel and governor on any four points.
- (d) Why roller follower is preferred over a knife edge follower ? State two advantages and applications of roller follower.
- (e) A vertical shaft 150 mm in diameter and rotating at 100 rpm rests on a flat end footstep bearing. The shaft carries vertical load of 20 kN. Assuming uniform pressure distribution and coefficient of friction equal to 0.05, estimate power lost in friction.
- (f) Four masses are 260 kg, 160 kg, 300 kg and 200 kg. The corresponding radii of rotation 300 mm, 250 mm, 150 mm and 200 mm respectively. The angle between successive masses is 0° , 45° , 90° and 135° . Find the position and magnitude of balancing mass required, if its radius of rotation is 200 mm by using graphical method.

5. Attempt any TWO :**16**

- (a) PQRS is a four bar chain with link PS fixed. The lengths of the links are $PQ = 62.5$ mm, $QR = 175$ mm, $RS = 112.5$ mm and $PS = 200$ mm. The crank PQ rotates at 10 radian/sec in clockwise direction. Draw the velocity and acceleration diagram when $\angle QPS = 60^\circ$ and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.
- (b) Construct the profile of a cam to suit the following specifications :
 - Cam shaft diameter = 40 mm
 - Least radius of cam = 25 mm
 - Diameter of roller = 25 mm
 - Angle of lift = 120°
 - Angle of fall = 150°
 - Lift of the follower = 40 mm
 - Number of pauses are two of equal interval between motions.
 - During the lift the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is offset by 12.5 mm from the centre of the cam.

P.T.O.

- (c) Two parallel shafts whose centre line are 4.8 m apart, are connected by open belt drive. The diameter of larger pulley is 1.5 m and that of smaller pulley 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. Taking centrifugal tension into account, calculate the power transmitted when the smaller pulley rotates at 400 r.p.m.

6. Attempt any TWO :

16

- (a) (i) Give classification of gear train.
(ii) Differentiate between flywheel and governor (any four points)
- (b) A simple band brake is operated by lever 40 cm long. The brake drum diameter is 40 cm and brake band embraces $\frac{5}{8}$ of its circumference. One end of band is attached to a fulcrum. The coefficient of friction is 0.25. The effort applied at the end of lever is 500 N. Find braking torque applied if drum rotates, anticlockwise and acts downwards.
- (c) 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 a clutch at a speed of 2500 rpm. Assume uniform condition.
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