

17412

15116

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.

Marks

1. a) **Attempt any SIX of the following :** **12**
- (i) Define –
 (1) Mechanism
 (2) Inversion of mechanism
- (ii) State any two types of motion of the follower.
- (iii) Define slip and creep in belt drive.
- (iv) State any two advantages of V belt drive over flat belt drive.
- (v) State the function of flywheel in I.C. Engine.
- (vi) Define stability and hunting of governor.
- (vii) Compare brakes and dynamometers. (Any two points)
- (viii) State any two adverse effects of imbalance.
- b) **Attempt any TWO of the following :** **8**
- (i) Draw neat sketch of crank and slotted lever mechanism. Label all parts.
- (ii) What is the necessity of clutch ? State its types.
- (iii) Draw the neat sketch of epicyclic gear train and explain how it works.

P.T.O.

17412

[2]

Marks**2. Attempt any FOUR of the following :****16**

- a) State and explain various types of constrained motions with suitable examples.
- b) Draw the neat labelled sketch of oldham's coupling. State its application.
- c) Define the terms linear velocity, relative velocity, angular velocity and angular acceleration.
- d) For a single slider crank mechanism, state the formulae to calculate by analytical method –
 - (i) Velocity of slider
 - (ii) Acceleration of slider
 - (iii) Angular velocity of connecting rod
 - (iv) Angular acceleration of connecting rod.Also, state the meaning of each term.
- e) Define the following terms related to cams
 - (i) Trace point
 - (ii) Pitch curve
 - (iii) Prime circle
 - (iv) Lift or stroke
- f) A casting weighing 9 kN hangs freely from a rope which makes 2.5 turns round a drum of 300 mm diameter revolving at 20 rpm. The other end of the rope is pulled by a man. Taking $\mu = 0.25$, determine
 - (i) the force required by the man
 - (ii) the power to raise the casting.

17412

[3]

Marks**3. Attempt any FOUR of the following :****16**

- a) In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise. The link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°
- b) In a single slider crank mechanism, crank AB = 20 mm and connecting rod BC = 80 mm. Crank AB rotates with uniform speed of 1000 rpm in anticlockwise direction. Find
 - (i) angular velocity of connecting rod BC and
 - (ii) Velocity of slider C when crank AB makes angle of 60° with the horizontal.
- c) State the formulae to calculate the length of open belt drive and cross belt drive. State the meaning of each term by drawing suitable diagrams in both cases.
- d) Draw the neat sketch of single plate clutch and explain its working.
- e) State the procedure of balancing single rotating mass when its balancing mass is rotating in the same plane as that of disturbing mass.
- f) Give detailed classification of followers.

4. Attempt any FOUR of the following :**16**

- a) What is centrifugal tension ? State its formula. Explain its effect on power transmitted by a belt drive.
- b) State the meaning of sliding pair, turning pair, rolling pair and spherical pair with one example each.
- c) Draw turning moment diagram for single cylinder four stroke I.C. Engine. Label all parts.
- d) Explain the working of rope brake dynamometer with neat sketch.
- 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.

P.T.O.

17412

[4]

Marks

- f) Four masses m_1 , m_2 , m_3 and m_4 are 200 kg, 300 kg, 240 kg, and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45° , 75° and 135° . Find the position and magnitude of balance mass required, if its radius of rotation is 0.2 m.

5. Attempt any TWO of the following :

16

- a) The crank and connecting rod of a reciprocating engine are 200 mm and 700 mm respectively. The crank is rotating in clockwise direction at 120 rad/s. Draw Klein's construction and find
- Velocity and acceleration of the piston
 - Angular velocity and angular acceleration of the connecting rod at the instant when the crank is at 30° to IDC (inner dead centre)
- b) A cam is to give the following motion to a knife edged follower :
- Outstroke during 60° of cam rotation.
 - Dwell for the next 30° of cam rotation.
 - Return stroke during next 60° of cam rotation.
 - 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. The follower moves with uniform velocity during both the outstroke and return stroke. Draw the profile of the cam when the axis of the follower passes through the axis of the camshaft.
- 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 rpm.

17412

[5]

Marks**6. Attempt any TWO of the following :****16**

- a) (i) State and explain law of gearing with the help of suitable sketch.
- (ii) Compare flywheel and governor (Any 4 points)
- b) In a simple band brake, the band acts on the $\frac{3}{4}$ th of 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 the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the
- (i) anticlockwise direction and
- (ii) clockwise direction
- 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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