

17412

21314

3 Hours / 100 Marks

Seat No.

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- 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. a) Attempt any **SIX** of the following: 12
- i) List out various types of clutches used to transmit the power.
 - ii) Write the classification of follower.
 - iii) What are the two advantages and disadvantages of chain drive ?
 - iv) List out various types of bearings used.
 - v) State the function of governor.
 - vi) Define fluctuation of speed and fluctuation of energy.
 - vii) State type of brakes.
 - viii) What is balancing? What are the methods of balancing?

P.T.O.

b) Attempt any **TWO** of the following:

8

- i) Define kinematic pair and state its type.
- ii) State types of clutch and its applications.
- iii) State one application of each. V-belt drive, flat belt drive, gear drive and chain drive.

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

16

- a) Differentiate between machine and structure.
- b) Describe with neat sketch the working of a crank and slotted lever quick return mechanism.
- c) State the formula for calculating
 - i) velocity
 - ii) acceleration of piston and connecting rod using analytical method.
- d) Explain Klein's construction of determine velocity and acceleration of different links in single slider crank mechanism.
- e) Why roller follower is preferred over a knife edge follower.
- 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 of 500 r.p.m. Find the power in KW transmitted by the belt.

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 r.p.m clockwise, while the link CD = 80 mm oscillates about D. BC and AB are of equal length. Find the angular velocity of link CD when angle BAD = 60° .
- b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine linear velocity and acceleration of the mid point of the connecting rod at a crank angle of 45° from inner dead center position.
- c) State types of gear train and explain any one.
- d) Draw a neat labeled sketch of multiplate clutch and state its working.
- e) Explain the method of balancing of different masses revolving in the same plane.
- f) State different types of cam and follower motion.

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

- a) Write the equation relating tension on slack and tight side. Explain in brief the term in it in case of flat belt.
- b) Justify with neat sketch elliptical trammel as an inversion of double slider crank chain.
- c) Draw and explain the turning moment diagram of four stroke I.C engine.
- d) Explain with neat sketch construction and working of eddy current dynamometer.
- e) A single plate clutch with both sides effective, has outer and inner diameter 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 2500 r.p.m.

- f) 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 rotations 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 the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm.

5. Attempt any TWO of the following:

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 rad is clockwise. 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) A cam is to be designed for a knife edge follower with the following data:
- cam lift = 40 mm during 90° of cam rotation with SHM.
 - Dwell for the next 30° .
 - During the next 60° of cam rotation, the follower returns to its original position with S.H.M.
 - Dwell during the remaining 180°

Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

- c) An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 meter apart and transmits 4 KW from the smaller pulley that rotates at 300 r.p.m. coefficient of friction between the belt and the pulley is 0.3 and the safe working tension is 10 N per mm width. Determine:
- minimum width of the belt
 - Initial belt tension and
 - length of belt required.

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

16

- Explain with sketch working principle of epicyclic gear trains.
 - Compare flywheel and governor.
- A band brake 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
 - anticlockwise direction and
 - clockwise direction.
- List out the various inversions of double slider crank chain and explain the working of Oldham's coupling with the help of neat sketch.

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