21819

3 Hours / 100 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) 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**

(a) State any four inversions of single slider crank chain.

(b) List four types of followers.

(c) Name the different materials used for belts used in power transmission.

(d) State the different types of chains used in power transmission.

(e) State the function of flywheel.

(f) Define the sensitivity in relation to governor.

(g) Give the classification of dynamometers.

(h) Define balancing. State its necessity.

(B) Attempt any TWO of the following : **8**

(a) Identify the basic kinematic chains to which following mechanisms belong :

(i) Oldham's coupling

(ii) Whitworth's quick return mechanism

(iii) Pantograph

(iv) Elliptical trammel

(b) Describe the working of centrifugal clutch with neat sketch.

(c) Define the following terms related with gear terminology :

(i) Module (ii) Diametral pitch

(iii) Circular pitch (iv) Pitch point

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

(a) Describe working of Scotch-Yoke mechanism with neat sketch.

(b) Describe completely constrained motion and successfully constrained motion with neat sketches.

(c) Define :

(i) Absolute velocity

(ii) Relative velocity

(d) Explain with neat sketch the construction of velocity diagram for single slider crank mechanism by Klein's construction.

(e) Why roller follower is preferred over knife edge follower ? State two applications of roller follower.

(f) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt drive. Find the length of the belt required and the angle of contract between the belt and each pulley.

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

(a) In a slider crank mechanism, the length of crank AB is 150 mm. The connecting rod BP is 500 mm long. The crank rotates at 500 r.p.m. in clockwise direction. Find the velocity and acceleration by Klein's construction method when the crank makes an angle of 45° to inner dead centre.

(b) In a four bar chain ABCD, AD is fixed and 150 mm long. The crank is AB is 40 mm long and rotates at 120 rpm clockwise, while 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°.

(c) State four advantages of V-belt drive over flat belt drive.

(d) Explain the different theories used in design of clutches and bearings.

(e) Four masses M1, M2, M3 and M4 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. The angles between successive masses are 45°, 75° and 135°. Use analytical method and find the position and magnitude of balance mass required if its radius of rotation is 0.3 m.

(f) Define following terms related to cam and follower :
   (i) Pitch curve
   (ii) Pressure angle

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

(a) What parameters are considered for selecting a chain drive for power transmission ?

(b) Explain the mechanism used in shaper machine to obtain quick return motion of ram.

(c) Differentiate between flywheel and governor.

(d) Describe working of rope brake dynamometer with the help of neat sketch.

(e) A multiplate clutch has to transmit 50 kW power at 1750 rpm. The co-efficient of friction surfaces is 0.12. The intensity of pressure is limited to 0.15 N/mm^2. The internal radius is 90 mm and external radius is 120 mm. Find the number of plates to transmit the required torque.

(f) The 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 positions of masses B, C and D are 60°, 135° and 270° from mass A. Use graphical method and find position and magnitude of balancing mass required if radius of rotation is 100 mm.

5. Attempt any TWO of the following : **16**

(a) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and connecting rod is 500 mm long.
Determine :
   (i) Linear velocity and acceleration of the mid-point of the connecting rod
   (ii) Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position..

(b) Draw the cam profile with roller follower to describe the following motions :
(i) Follower to move outwards through 2.4 cm during 120° of cam rotation.
(ii) Follower to dwell for next 60° of cam rotation.
(iii) Follower to return to its initial position in the next 120° of cam rotation.
(iv) Follower to dwell for rest of cam rotation.
The minimum radius of cam is 4.5 cm. The line of stroke of the follower is offset by 1.5 cm and roller radius is 1 cm. Displacement of follower takes place with uniform acceleration and retardation for both the outward and inward stroke.

(c) A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is (i) open belt drive, (ii) cross belt drive.
Take $\mu = 0.3$. Assume suitable data is necessary.

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

(a) (i) Explain working of flywheel with the help of turning moment diagram.
(ii) Explain epicyclic gear train with neat sketch.

(b) A single plate clutch transmits 25 kW at 900 r.p.m. The maximum pressure intensity between the plates is 85 kN/m^2. The outer diameter of the plate is 360 mm. Both the sides of the plate are effective and the co-efficient of friction is 0.25. Determine :
(i) Inner diameter of plate
(ii) The axial force to engage the clutch

(c) A band brake as shown in figure carries a brake drum of 1 m diameter. It weighs 300 kg with its radius of gyration of 30 cm and it runs at 300 rpm. The co-efficient of friction between the drum and band is 0.25. Determine the torque applied on the brake drum by a pull of 100 N at the end of lever and number of revolutions the drum makes before it comes to rest.