Duration: 3 Hrs   Marks: 80

Instructions:

i)   Question no. 1 is compulsory
ii)   Solve any three questions from remaining.
iii)   Assume suitable data wherever necessary.
iv)   Figure to the right indicates full marks.

Q.1   Solve **any four** questions

a) Explain any one inversion of double slider crank chain in details.   (05)

b) Explain Tchebicheff's mechanism with neat sketch.   (05)

c) Define the following terms as applied to a cam with an neat sketch   (05)

    i) Base circle

    ii) Pitch circle

    iii) Prime circle

d) Differentiate between involutes and cycloidal gear tooth profile   (05)

e) State and explain the law of belting.   (05)

Q. 2 a) The driving crank AB of the quick return mechanism as shown in figure (14)
         revolves at a uniform speed of 200 rpm. Find the velocity and acceleration
         of the toolbox R, in the position have shown when the crank makes an
         angle of 600 with the vertical line of centre's PA. What is the acceleration
         of sliding of the block at 'B' along the slotted lever PQ?
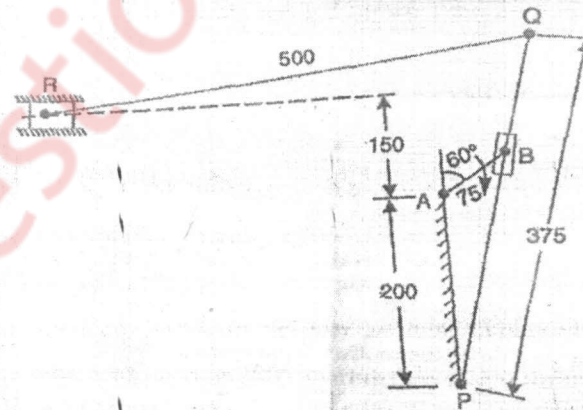
All dimensions in mm.

b) Explain Whitworth quick return motion mechanism with neat sketch.   (06)

Q.3 a) A cam with a minimum radius of 25 mm is to be designed (14)
for a knife edge follower with the following data:

i) Follower to move outwards through 35 mm during 60° of cam rotation.

ii) Follower to dwell for the next 40° of cam rotation.

iii) Follower to return to its starting position during next 90° of cam rotation.

iv) Follower to dwell for the rest of the cam rotation.

If the outstroke and return stroke of the cam is with SHM and UARM respectively. Draw the displacement, velocity, acceleration and jerk diagram if the cam rotates at 150 rpm.

b) What is primary and secondary instantaneous centre? Explain with the (06) help of diagram?

Q.4 a) A uniform bar of mass 'm' and length 'L' hangs from a frictionless hinge. (10) It is released from the horizontal position. Find the angular velocity of the centre of mass 'G' when it is vertical position. Solve by work energy principle.

b) Derive an expression for the minimum number of teeth required on the (10) pinion in order to avoid interference in involute gear teeth when it meshes with wheel.

Q.5 a) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in (10) diameter, running at speed 250 r.p.m. The angle embraced is 165^0 and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for belt is 1.5 MPa, density of leather 1 Mg/m³ and the thickness of the belt 10 mm, determine the width of belt taking centrifugal tension into account.

b) Sketch the Davis steering gear mechanism and show that it satisfies the (10) condition for correct steering. Inspite of this, explain why in actual practice Ackerman steering gear is preferred to the former?

Q.6 a) Derive an expression for length of cross belt drive. (10)

b) The pinion having 30 teeth drives a gear having 80 teeth. The profile of the (10) gear is involute with 20^0 pressure angle, 12 mm module and 10 mm addendum. Find the length of contact, arc of contact and the contact ratio.