



PART B — (5 × 13 = 65 marks)

11. (a) Sketch and describe the working of crank and slotted lever quick return mechanism. Derive an expression to find the length of the stroke for the quick return mechanism. (13)

Or

- (b) Describe the watts parallel mechanism for straight line motion and derive the condition under which the straight line is traced. (13)
12. (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/s 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. (13)

Or

- (b) In a pin jointed four bar mechanism ABCD, length of links  $AB = 300$  mm,  $BC = CD = 360$  mm and  $AD = 600$  mm. The angle  $BAD = 60^\circ$ . The crank AB rotates uniformly at 100 rpm. Locate all the instantaneous centre and find the angular velocity of link BC. (13)
13. (a) Draw the profile of a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to  $60^\circ$  of cam rotation. The valve must remain in the fully open position for  $20^\circ$  of cam rotation.

The lift of the valve is 37.5 mm and the least radius of cam is 40 mm. The follower provided with a roller radius of 20 mm and its line of stroke passes through the axis of the cam. (13)

Or

- (b) In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is  $75^\circ$  and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate
- (i) The principal dimensions of the cam
- (ii) The acceleration of the follower at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. (13)

14. (a) Derive an expression to find the minimum number of teeth on the pinion to avoid interference of gears. (13)

Or

- (b) An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels. D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A co-axial with F. If the wheels have the same pitch and the shaft A makes 800 rpm. What is the speed of the shaft F? (13)
15. (a) A multi disc clutch has three discs on the driving shaft and two on the driven shaft. The outside diameter of the contact surface is 240 mm and the inside diameter is 120 mm. Assuming uniform wear and coefficient of friction as 0.3. Find the maximum axial intensity of pressure between discs for transmitting 25 KW at 1575 rpm.

Or

- (b) Derive an expression to find the length of a belt in an open belt drive. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A simple band brake operates on a drum of 600 mm in diameter that is running at 200 rpm. The coefficient of friction is 0.25. The brake band has a contact of  $270^\circ$ , one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle of contact
- (i) What is the pull necessary on the end of the brake arm to stop the wheel if 35 KW is being absorbed? What is the direction for minimum pull?
- (ii) What width of steel band of 2.5 mm thick is required for this brake if the maximum tensile stress is not to exceed  $50 \text{ N/mm}^2$ ? (15)

Or

- (b) The mean diameter of the screw jack having pitch of 10 mm is 50 mm. A load of 20 KN is lifted through a distance of 170 mm. Find the work done in lifting the load and efficiency of screw jack when
- (i) the load rotates with the screw and
- (ii) the load rests on the loose head which does not rotate with the screw the external and internal diameters of the bearing surface of the loose head are 60 mm and 10 mm respectively. The coefficient of friction for the screw as well as the bearing surface may be taken as 0.08. (15)

