

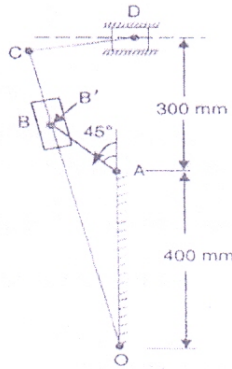
- N.B. : (1) Question No. 1 is compulsory.
 (2) Attempt any four questions out of the remaining six.
 (3) Assume suitable data if necessary but justify the same.
 (4) Figures to the right indicate full marks.

- Q1. Attempt any four (20)
- What are the conditions to be satisfied in replacing a rigid body to a two mass system so that it is equivalent dynamical system?
 - What are the advantages and disadvantages of chain drive over belt drive?
 - Explain Grubler's criterion and using the same deduce minimum number of links required to form a mechanism
 - Determine the minimum number of teeth on a pinion for involute rack in order to avoid interference.
 - State and explain the concept of Work – Energy principle.
- Q2 A. Derive the equation for the length of a cross belt drive. (10)
- B. Two mating gear wheels have 20 and 40 involute teeth of 10 mm module and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel and the length of the line of contact. If the smaller wheel rotates at 250 rpm, find the velocity of point of contact along the surface of each tooth at the instant when the tip of a tooth on a smaller wheel is in contact. (10)
- Q3 A. A punching machine carries out 6 holes per minute. Each hole of 40 mm diameter in 35 mm thick plate requires 8 N-m of energy / mm^2 of the sheared area. The punch has a stroke of 95 mm. Find the power of the motor required if the mean speed of the flywheel is 20 m/s. If the total fluctuation of speed is not to exceed 3% of the mean speed, determine the mass of the flywheel. (10)
- B. Explain in detail with the help of neat sketches Ackerman and Davis steering gear mechanism. (10)
- Q4 A. With the help of neat sketch explain gear terminology. (10)
- B. A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 rpm. The reciprocating parts have a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead center, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2 . Calculate the effective turning moment on the crank shaft. (10)

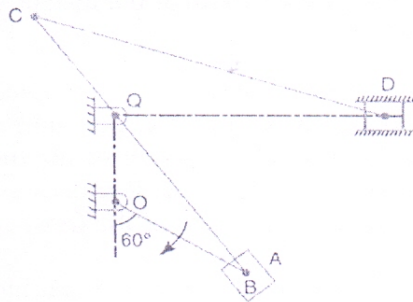
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- Q5 A. A mechanism of a crank and slotted lever quick return motion is shown in the figure. If the crank rotates counter clockwise at 120 rpm, determine for the configuration shown, the velocity and acceleration of the ram D. Also determine the angular acceleration of the slotted lever. (14)

Crank AB = 150 mm, Slotted arm OC = 700 mm and link CD = 200 mm.



- B. A motor provides a constant torque of $M = 150 \text{ N-m}$ to a hoisting pulley of mass 25 kg, radius 0.3 m and mass moment of inertia 0.9 kg-m^2 . The pulley rotates in clockwise direction and lifts 200 N block starting from rest. Determine speed of the block after it rises by 2 m. Use Work Energy principle. (6)
- Q6 A. Figure shows a Whitworth quick return motion mechanism. The various dimensions are : $OQ = 100 \text{ mm}$; $OA = 200 \text{ mm}$; $QC = 150 \text{ mm}$; $CD = 500 \text{ mm}$. The crank OA makes an angle of 60° with the vertical and rotates at 120 rpm in the clockwise direction. By instantaneous center method find the velocity of the ram D. Compare your answer with relative velocity method. (14)



- B. State and explain D'Alembert's principle. (6)
- Q7 Write short notes on :- (20)
- Differentiate between Machine and Structure
 - Double Hooke's joint
 - Coriolis component of Acceleration
 - Law of Gearing