

- 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)

- A. Show that an elliptical trammel can trace an ellipse as well as a circle.
 B. What is slip and creep in belts?
 C. Differentiate between a machine and a structure.
 D. What is chordal action in chains?
 E. Derive the fundamental equation for the correct steering in steering gear mechanism.

Q2 A. The grooves on the pulley of a multi rope drive have an angle of 50° and accommodate ropes of 22 mm diameter having a mass of 0.8 kg per meter length for which a safe operating tension of 1200 N has been laid down. The two pulleys are of equal size. The drive is designed for maximum power conditions. Speed of both the pulleys is 180 rpm. Assuming coefficient of friction as 0.25, determine the diameters of the pulleys and the number of ropes when the power transmitted is 150 kW. (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)

Q3 A. Two mating gears have 20 and 40 involute teeth of module 10 mm 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 points half the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio. (10)

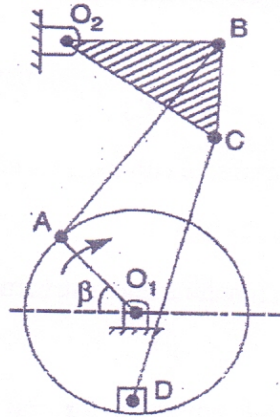
B. A punching machine carries out 6 holes per minute. Each hole of 40 mm diameter in 35 mm thick plate requires 8 N-m of energy / mm^2 of the sheared area. The punch has a stroke of 95 mm. Find the power of the motor required if the mean speed of the flywheel is 20 m/s. If the total fluctuation of speed is not to exceed 3% of the mean speed, determine the mass of the flywheel. (10)

Q4 A. With the help of a neat sketch explain gear terminology. (10)

B. Classify chain drive in detail. What are the advantages and disadvantages of chain drive over belt drive? (10)

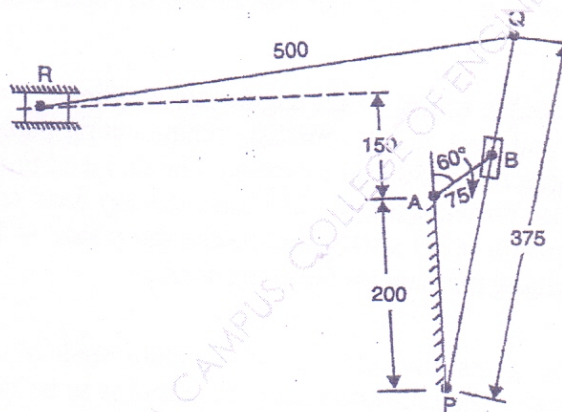
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- Q5 A. Figure shows a sewing needle bar mechanism O_1ABO_2CD wherein the different dimensions are as follows : Crank $O_1A = 16$ mm; angle $\beta = 45^\circ$; vertical distance between O_1 and $O_2 = 40$ mm; horizontal distance between O_1 and $O_2 = 13$ mm; $O_2B = 23$ mm; $AB = 35$ mm; angle $O_2BC = 90^\circ$; $BC = 16$ mm; $CD = 40$ mm. D lies vertically below O_1 . Find the velocity of needle at D for the given configuration. The crank O_1A rotates at 400 rpm. (14)



- B. Write a note on Work – Energy Principle. (6)

- Q6 A. The driving crank AB of a quick return mechanism revolves at a uniform speed of 200 rpm. Find the velocity and acceleration of the tool R, in the position shown, when the crank makes an angle of 60° with the vertical line of centers PA. What is the acceleration of sliding of the block at B along the slotted lever PQ? (14)



All dimensions in mm.

- B. What are the different types of Instantaneous Centers? (6)
- Q7. Write short notes on:- (20)
- Double Hooke Joint
 - Flywheel and its applications
 - Law of Gearing
 - Differentiate between cycloidal and involute teeth.