

(8)

SE - sem-IV - Mechanical - TOM-I

21/5/15

(OLD COURSE)

QP Code : 3980

(3 Hours)

[Total Marks : 100

- 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. What are the different types of constrained motions?
B. Derive the fundamental equation for correct steering in steering gear mechanism.
C. What is a flywheel? What do you mean by fluctuation of energy?
D. State and explain law of gearing.
E. What is initial tension in a belt drive?

Q2 A. Two mating gear wheels have 20 and 40 involute teeth of 10 mm module and 20° (10)

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.

B. Derive the equation for the length of an open belt drive. (10)

Q3 A. A flat belt is required to transmit 35 kW from a pulley of 1.5 m effective diameter (10)

running at 300 rpm. The angle of contact is spread over $11/24$ of the circumference and the coefficient of friction between the belt and pulley surface is 0.3. Determine, taking centrifugal tension into account, width of the belt required. It is given that the belt thickness is 9.5 mm, density of its material is $1.1 \times 10^3 \text{ kg/m}^3$ and the related permissible working stress is 2.5 N/mm^2 .

B. A riveting machine is driven by a constant torque 3 kW motor. The moving parts (10)

including the flywheel are equivalent to 150 kg at 0.6 m radius. One riveting operation takes 1 second and absorbs 10000 N-m of energy. The speed of the flywheel is 300 rpm, before riveting. Find the speed immediately after riveting. How many rivets can be closed per minute?

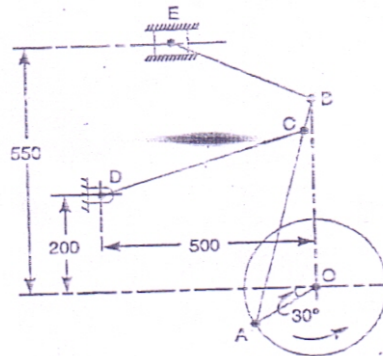
Q4 A. With the help of a neat sketch explain the gear terminology. (10)

B. The following data relate to a connecting rod of a reciprocating engine:- (10)

Mass = 55 kg; distance between bearing centers = 850 mm; diameter of small end bearing = 75 mm; diameter of big end bearing = 100 mm; time of oscillation when the connecting rod is suspended from small end = 1.83 s; time of oscillation when the connecting rod is suspended from big end = 1.68 s.

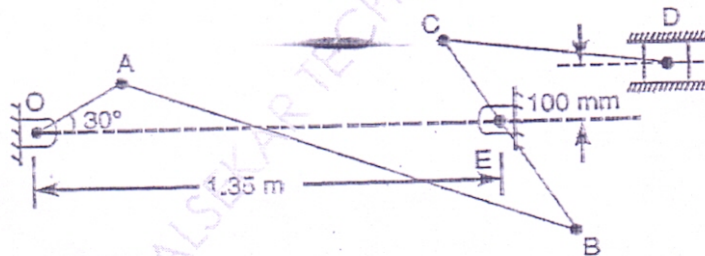
Determine i) the radius of gyration of the rod about an axis passing through the center of gravity and perpendicular to the plane of oscillation; ii) the moment of inertia of the rod about the same axis and iii) the dynamically equivalent system for the connecting rod, constituted of two masses, one of which is situated at the small end center.

- Q5 A. Figure shows the mechanism of a radial valve gear. The crank OA turns uniformly at 150 rpm and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as center and DC as radius. The dimensions of various links are: OA = 150 mm; AB = 550 mm; AC = 450 mm; DC = 500 mm; BE = 350 mm. Determine velocity and acceleration of the ram E for the given position of the mechanism. (15)



- B. Write a note on D'Alembert's principle. (5)

- Q6 A. A mechanism as shown in the figure has the following dimensions: (12)
 OA = 200 mm; AB = 1.5 m; BC = 600 mm; CD = 500 mm and BE = 400 mm. If crank OA rotates uniformly at 120 rpm clockwise find using I.C. method.
 i) velocity of B, C and D ii) angular velocity of the links AB, BC and CD.



- B. With the help of a polar diagram show the salient features of driven shaft speed in case of Hooke's joint. What is the condition for equal speeds of the driving and driven shaft? (8)

- Q7 Write short notes on (Any four):- (20)

- Differentiate between cycloidal and involute teeth.
- Work energy principle and conservation of energy.
- Inversion of mechanism.
- Types of Instantaneous centers.
- Advantages and disadvantages of chain drive over belt drive.