Belt Drives Tutorial Sheet

1. A flat belt drive is required to transmit 5 kW at a speed of 240 rev/min with the smaller pulley of 300 mm effective diameter. The angle of lap between belt and pulley is 150° and the coefficient of friction between belt and pulley is 0.3. Determine the magnitude of the tensions in the tight and slack side of the belt.

2. Determine the difference in tensions for a belt drive which transmits 800 W when the belt speed is 240 m/min.

3. A belt driven pulley of diameter 420 mm and rotating at 240 rev/min is to transmit 1.5 kW. If the tension in the tight side of the belt is 540 N, calculate the tension in the slack side.

4. The maximum permissible force in a belt material is 80 N per cm of belt width. Rotating at 900 rev/min, 4 kW of power is transmitted from a pulley 200 mm in effective diameter. For the drive system, the tension in the tight side of the belt is to be twice the tension in the slack side. Determine the necessary width of belt required to the nearest cm.

5. Calculate the maximum power which can be transmitted by a flat belt drive with an angle of lap of 135°, belt speed 18 ms^{-1} and coefficient of friction between belt and pulley is 0.3, if the maximum belt tension is 250 N.

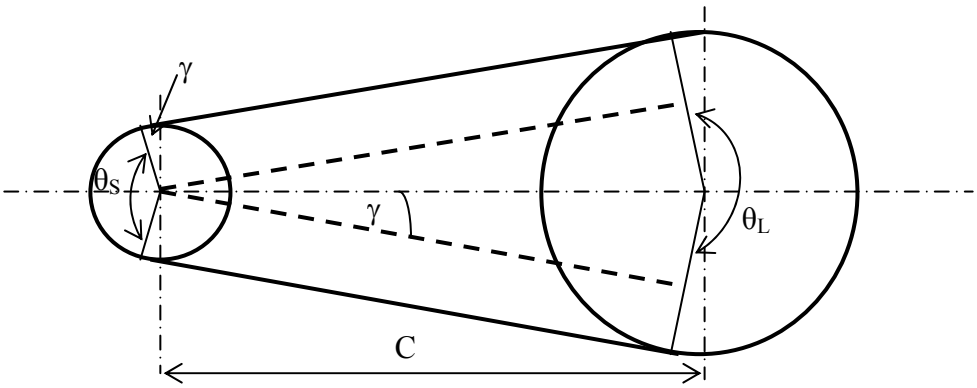
6. An open flat belt drive connects two pulleys each 360 mm effective diameter with a coefficient of friction between belt and pulley surface of 0.4. Calculate the tight and slack side belt tensions if the drive transmits 5 kW when the pulley speed is 450 rev/min.

7. A flat belt drive is to transmit 8 kW across two pulleys each 500 mm diameter and rotating at 420 rev/min. The coefficient of friction between belt and pulley is 0.38. If the belt material is manufactured in various widths in increments of 1 cm, and a maximum tension of 180 N per cm of belt width is permitted, calculate the width of a suitable belt.

8. Calculate the maximum power transmitted by a vee-belt drive with a pulley 150 mm effective diameter, angle of lap of 165°, speed of rotation 360 rev/min, maximum permissible belt tension 450 N, coefficient of friction between belt and pulley 0.3, and pulley groove angle 40°.

9. The mean diameter of the driving pulley for a vee-belt drive with two belts is 110 mm. The pulley groove angle is 40° and the drive transmits 4.4 kW at a speed of rotation of 1500 rev/min. The coefficient of friction between belt and pulley 0.32, and the angle of lap is 160°. Determine the driving torque and the maximum stress in the belt material if the cross-sectional area of each belt is 120 mm^2.

10. A multiple vee-belt drive with a groove angle of 40° is required to transmit 18.4 kW from a pulley 155 mm in diameter to another pulley 310 mm in diameter rotating at 265 rev/min (See figure over page). If the coefficient of friction between the belt and the pulley is 0.35 and the maximum permissible belt tension is 450 N for each of the ten belts used, calculate:(i) the torque on the smaller pulley; (ii) the angle of lap (θ) required to achieve this power rating; (iii) the ideal centre distance (C).



Tutorial : Belt Drive System Design - Answers

1. 2437 N and 1111 N
2. 200 N
3. 255.8 N
4. 11 cm
5. 2.281 kW (ignoring centrifugal tension); 1.520 kW (including centrifugal tension)
6. 824 N and 234.5 N
7. 6 cm
8. 1.171 kW
9. 28 Nm; 2.288 N/mm^2
10. 331.52 Nm; 168 degrees; 767.5 mm