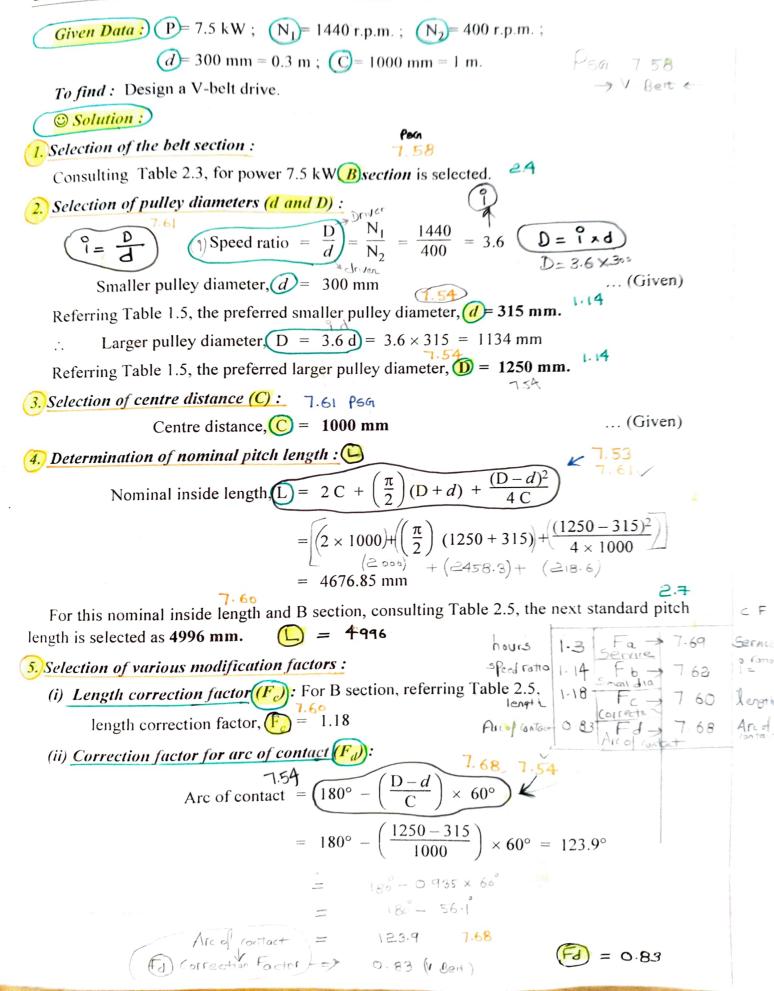
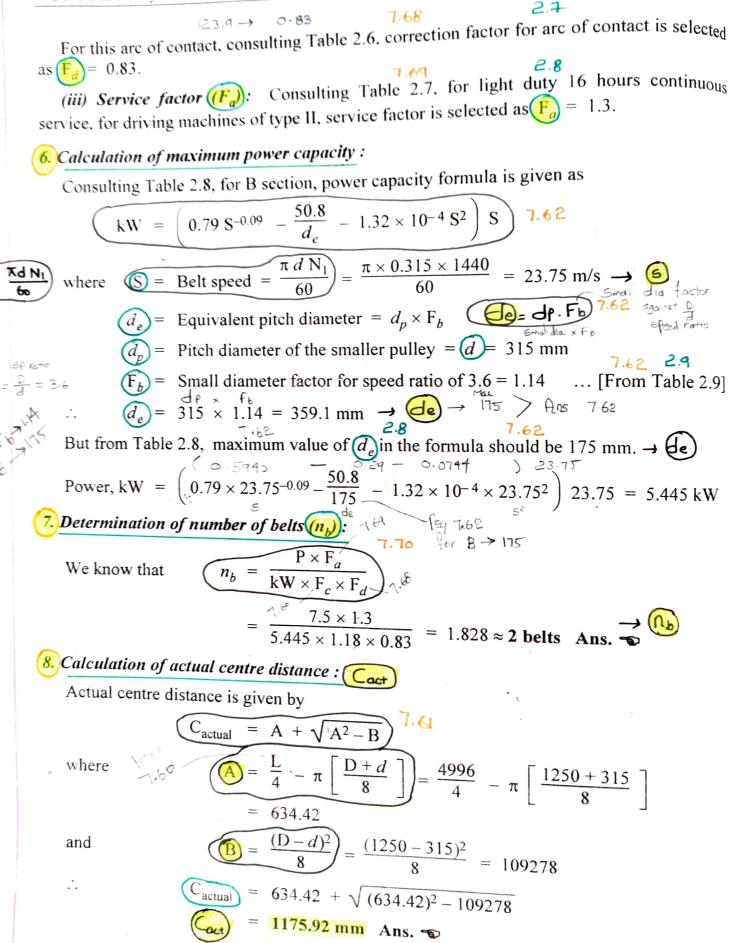
**Example 2.2** Design a V-belt drive to the following specifications : X Model Power to be transmitted = 7.5 kWx Sen Speed of driving wheel = 1440 r.p.m. N. Speed of driven wheel = 400 r.p.m.Nz Diameter of driving wheel = 300 mm C Centre distance = 1000 mm Service = 16 hours / day





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2.11

<i>Example</i> (2.3) A centrifugal pump running at 340 r.p.m is to be driven by a 100 kW
motor running at 1440 r.p.m. The drive is to work for atleast 20 hours every day. The
centre distance between the motor shaft and the pump shaft is 1200 mm Suggest a suitable
multiple V-belt drive for this application. Also calculate the actual belt tensions and stress
induced, $\leq \text{feed}(\text{driven})$ former $\leq \text{feed}(\text{driven})$ (oner distance) Given Data $N_2 = 340 \text{ r.p.m.}$ ; $P = 100 \text{ kW}$ ; $N_1 = 1440 \text{ r.p.m.}$ ; $C = 1200 \text{ mm} = 1.2 \text{ m}$
To find: (i) Design a V-belt drive, and Service = 20 Hours/day
(ii) Actual belt tensions and stress induced.
<sup>(C)</sup> Solution :
1. Selection of the belt section :
Consulting Table 2.3, for power 100 kW Dection is selected.
2. Selection of pulley diameters (d and D) :
Since diameters of both pulleys are not given, therefore first select the smaller pulley diameter from Table 2.3. 7.58
$\therefore$ Consulting Table 2.3, for power 100 kW, smaller pulley diameter, $d = 355 \text{ mm}$
Speed ratio = $\frac{D}{d} = \frac{N_1}{N_2} = \frac{1440}{340} = 4.235$ (1)
$\therefore$ Larger pulley diameter, D = $4.235 \times d$ = $4.235 \times 355$ = 1503.53 mm
Consulting Table 1.5, the preferred larger pulley diameter, $D = 1600 \text{ mm}$ . $754$
3. Selection of centre distance (C):
Centre distance, $C = 1200 \text{ mm}$ (Given)
4. Determination of nominal pitch length: 7.53
Nominal inside length $L = 2C + \frac{\pi}{2}(D+d) + \frac{(D-d)^2}{4C}$
$= 2 \times 1200 + \frac{\pi}{2} (1600 + 355) + \frac{(1600 - 355)^2}{4 \times 1200}$
= 5793.83 mm
For this nominal inside length and D section, consulting Table 2.5, the next standard pitch length is selected as $(6124 \text{ mm}. \bigcirc) - 1.6^{\circ}$
5. Selection of various modification factors :
(i) Length correction factor: For D section, referring Table 2.5, length correction factor,
(F <sub>c</sub> = 1.00) 7.60 Correction factor for Industrial Service   Ta   7.69 F Small dia factor   Tb   762 Correction factor   Tc   760 For Arc of contact   Td   768 K
Small dia tactor I C 7 60
Correction Jacion (Id) 768K
CI TUCO CTIN

2.12



Design of Transmission Systems

## 9. Calculation of belt tensions $(T_1 \text{ and } T_2)$ :

We know that,

Power transmitted per belt = 
$$(T_1 - T_2) v$$
  
 $\frac{100 \times 10^3}{8} = (T_1 - T_2) 26.76 \text{ or } T_1 - T_2 = 467.12 \dots$  (i)  
From Table 2.3, (mass) per metre length,  $m = 0.596 \text{ kg/m}$   
From Table 2.2, groove angle  $(2\beta) = 34^\circ$ .  
Argie A  
Already found that arc of contact for smaller pulley,  $\alpha = 117.75^\circ \times \frac{\pi}{180^\circ}$ 

= 2.055 radians

We know that the tension ratio for V-belts considering centrifugal tension,

$$\frac{T_1 - mv^2}{T_2 - mv^2} = e^{\mu\alpha / \sin\beta} = e^{\mu\alpha - \csc\beta}$$

$$\frac{T_1 - 0.596 (26.76)^2}{T_2 - 0.596 (26.76)^2} = e^{0.3 \times 2.055 \times \csc 17^\circ} = 8.237$$
or
$$T_1 - 8.237 T_2 = -3088.68 \qquad \dots \text{(ii)}$$
Solving (i) and (ii), we get
$$T_1 = 958.45 \text{ N} \text{ and } T_2 = 491.33 \text{ N} \text{ Ans.} \Rightarrow$$

or

ċ.

## 10. Calculation of stress induced :

Consulting Table 2.3, cross-sectional area of D section =  $475 \text{ mm}^2$ 

Stress induced = 
$$\frac{\text{Maximum tension}}{\text{Cross-sectional area}} = \frac{958.45}{475}$$
  
= 2.02 N/mm<sup>2</sup> Ans.