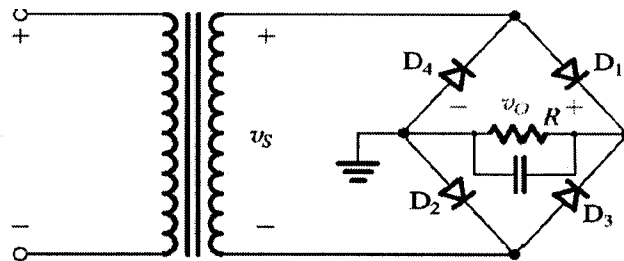ECE3455, Q4) In the circuit shown, the input of the transformer is a **triangular** wave with amplitude of 100[V] and frequency of 100 [Hz]. If $V_D(on)=0.7$ [V] and R= 100 [ohms]. If the average output voltage is 12 volts and the ripple is 2 V(pp).

(a) Find the value of the capacitor.
(b) Find the turn ratio of the transformer (N2/N1).
(c) Find the conduction angle and the average current of each diode, .

Solution:

$$V_0(av) = V_p - \frac{1}{2} V_r \Rightarrow 12 = V_p - \frac{1}{2} \times 2 \qquad V_p = 13 \text{ V}$$

$$V_S = V_p + 1.4 = 13 + 1.4 = 14.4 \text{ [V]}$$

a) $$C = \frac{V_p}{2 \cdot f \cdot R \cdot V_r} = \frac{13}{2 \times 100 \times 100 \times 2} = 325 \text{ } \mu F$$

b) $$n = \frac{N_2}{N_1} = \frac{V_S}{V_{line}} = \frac{14.4}{100} = 0.144$$

c) $$\theta = \frac{V_r}{V_p} \times 90 = \frac{2}{13} \times 90 = 13.84^{\circ}$$

$$I_D(av) = \frac{180}{\theta} \times \frac{V_p}{R} = \frac{180}{13.84} \times \frac{13}{100} =$$

$$I_D(av) = 1.69 \text{ A}$$