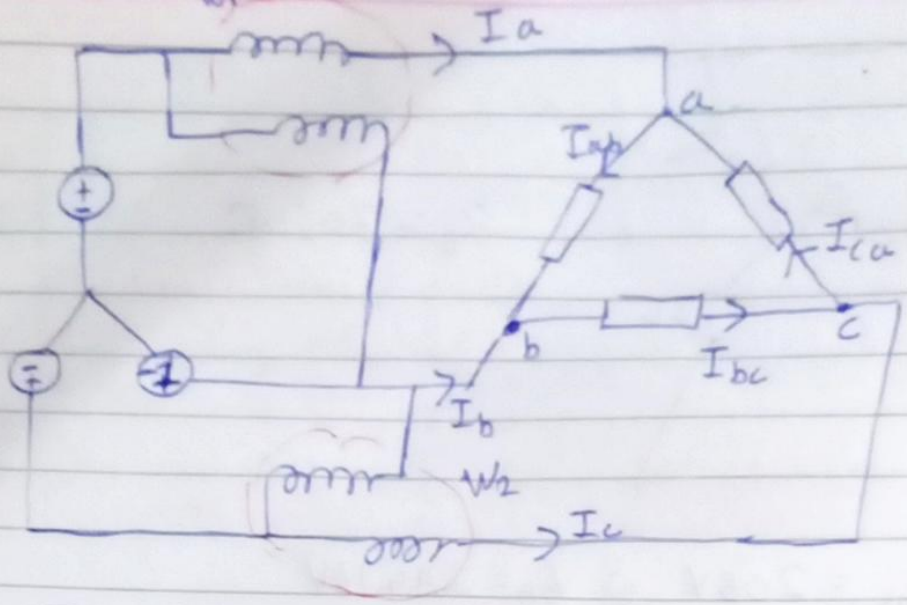
Q21



$Z = 25 \angle 60°$

a) $V_{ab_{RMS}} = 202V \Rightarrow V_{ab} = 285.67V$

$\therefore V_{an} = 164.93V$

$$I_{ab} = \frac{V_{ab}}{Z} = \frac{285.67 \angle 30°}{25 \angle 60°} = 11.42 \angle -30° \text{ A}$$

$$I_{bc} = \frac{V_{bc}}{Z} = \frac{285.67 \angle 150°}{25 \angle 60°} = 11.42 \angle 90° \text{ A}$$

$$I_{ca} = \frac{V_{ca}}{Z} = \frac{285.67 \angle 270°}{25 \angle 60°} = 11.42 \angle 210° \text{ A}$$

KCL at node @: $I_a + I_{ca} = I_{ab}$

$$\Rightarrow I_a = I_{ab} - I_{ca}$$
$$= 11.42 \angle -30 - 11.42 \angle 210$$
$$= 19.78 \angle 0$$

$\therefore I_{a_{RMS}} = \frac{19.78}{\sqrt{2}} = \boxed{13.99A}$

b) $P_{real} = \sqrt{3} \times I_{L\,RMS} \times V_{L\,RMS} \cos\theta$

$= \sqrt{3} \times 13.99 \times 202 \times \cos 60°$

$\boxed{P_{real} = 2.448\ kW}$