

HNC Electrical and Electronic Engineering

Year Two - 2014/15

Module: Electronics

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# ELECTRICAL & ELECTRONIC PRINCIPLES



## AC THEORY

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### 3.3 Wye (Y) configuration

Figure 10 shows the circuit with the delta ( $\Delta$ ) impedances replaced by their Wye (Y) equivalent impedances. Figure 1

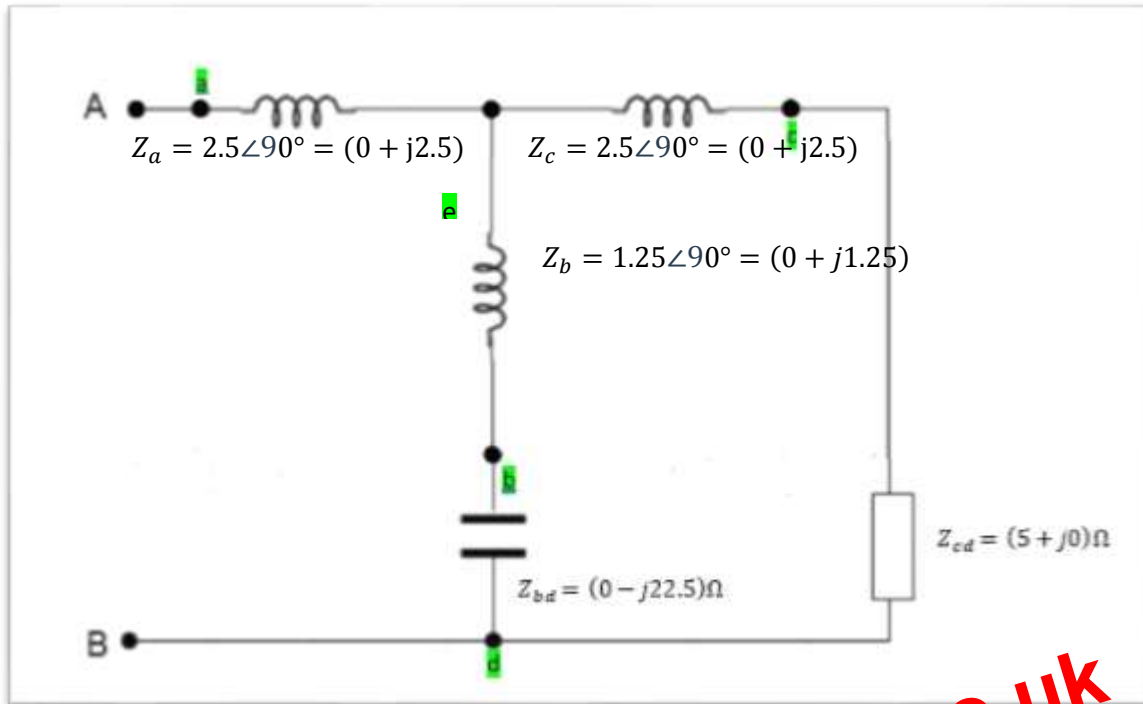


Figure 10: Circuit with  $\Delta$  replaced by Y equivalent

The overall circuit impedance is shown in Table 9.

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Table 14: Upper half-power frequency impedance calculations

(Q4e) Impedance at the upper half-power frequency, $f_h = 2525 \text{ Hz}$	
Inductance	Capacitance
$X_L = 2\pi f_h L$ $X_L = 2 \times \pi \times 2525 \times 190.985931 \times 10^{-3}$ $X_L = 3030 \Omega$	$X_C = \frac{1}{2\pi f_h C}$ $X_C = \frac{1}{2 \times \pi \times 2525 \times 21.22065908 \times 10^{-9}}$ $X_C = 2970.29703 \Omega$ $X_C = 2970 \Omega (0dp)$
$R = 60 \Omega$	$X_L - X_C = 3030 - 2970 = 60$
$\therefore Z = (60 + j60) \Omega$	

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**5.7 Current in the Inductor Branch****(Q5c)**

We can now calculate the current in the Inductor branch of the circuit. Remember in an inductor Voltage leads, Current lags.

Table 20: Current through the inductor

$R = 25 \Omega, \quad X_L = 1,414.235667 \Omega, \quad V_S = 14.14 V (rms)$	
<p><i>The total impedance in the inductor branch:</i></p> $Z_{RL} = \sqrt{R^2 + X_L^2}$ $Z_{RL} = \sqrt{25^2 + 1,414.235667^2}$ $Z_{RL} = \sqrt{625 + 2,000,062.522}$ $Z_{RL} = \sqrt{2,000,687.522}$ $Z_{RL} = 1,414.456617 \Omega$ $Z_{RL} = 1.414 k\Omega (3dp)$	<p><i>The current through the resistor – inductor branch:</i></p> $I_{RL} = \frac{V_S}{Z_{RL}}$ $I_{RL} = \frac{14.14}{1,414.235667}$ $I_{RL} = 9.998333609 mA$ $I_{RL} = 10.00 mA (rms)(2dp)$ $I_{RL} = 10.00 \angle -90^\circ mA$

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