HNC Electrical and Electronic Engineering

Year Two - 2014/15

Module: Electronics

ELECTRICAL & ELECTRONIC

PRINCIPLES

AC THEORY

Keith A. Hudson

06/11/2014

Tables

3.3 Wye (Y) configuration

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

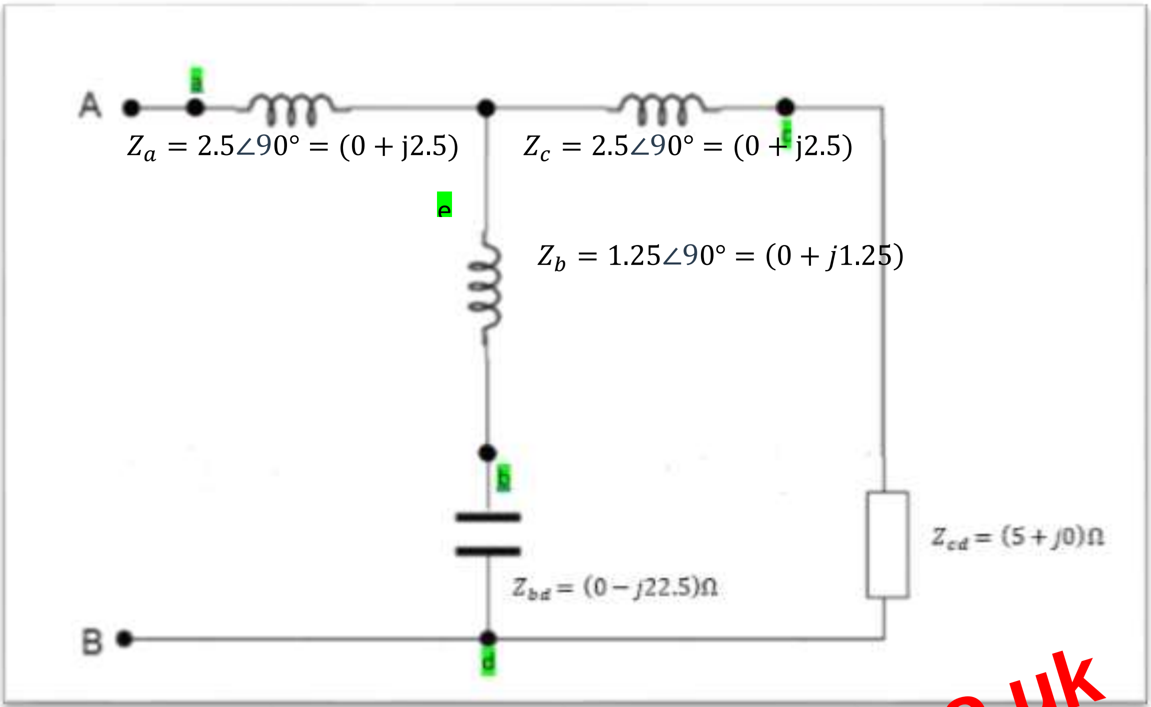

Figure 10: Circuit with Δ replaced by Y equivalent

The overall circuit impedance is shown in Table 9.

Table 14: Upper half-power frequency impedance calculations

(Q4e) Impedance at the upper half-power frequency, $f_h = 2525\ Hz$	
Inductance	Capacitance
$X_L = 2\pi f_h L$ $X_L = 2 \times \pi \times 2525 \times 190.985931 \times 10^{-3}$ $X_L = 3030\ \Omega$	$X_C = \frac{1}{2\pi f_h C}$ $X_C = \frac{1}{2\times\pi\times2525\times21.22065908\times10^{-9}}$ $X_C = 2970.29703\ \Omega$ $X_C = 2970\ \Omega\ (0dp)$
$R = 60\ \Omega$	$X_L - X_C = 3030 - 2970 = 60$
$\therefore Z = (60 + j60)\ \Omega$	

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

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