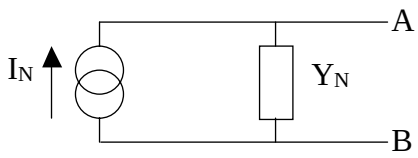
UEE 201 - THEORY OF ELECTRICTY - Answers

Final Part I Examination 1994/95 - October 1996

A1 (a) $Z_{AB} = 10 - j\,7.5\ \Omega$



(b) $Y_N = \dfrac{Z_1 + Z_2}{Z_1 Z_2}, \qquad I_N = I + \dfrac{E}{Z_1}$

(c) $I = I_1.\dfrac{E_3}{E_1} + I_2.\dfrac{E_4}{E_2}$

(d) 1200 W

(e) $E = j\omega L_1 i_1 + j\omega M i_2 + Z_1 (i_1 - i_2)$

(f) $290\angle 90^o$ V

(g) $9.708\angle 12.22^o$ A

A2 $P_{\max} = \dfrac{1.05\,E^2}{x}$, $R = 0.499\,x$, $X = -0.4756\,x$

A3 $L_1 = 39.79$ mH, $R_2 = 19.2\ \Omega$, $L_2 = 45.84$ mH, $R_3 = 0\ \Omega$, $C_3 = 79.58\ \mu$F

A4 (a) 5.37 A, (b) 383.5 V, (c) 0.942 lag

3 of 6.24 μF, 404.1 V

A5 8A current source in shunt with a 1 Ω resistor.

Branch-Node incidence matrix $= \begin{bmatrix} 1 & 0 \\ -1 & 1 \\ 0 & 1 \end{bmatrix}$, Branch admittance matrix $= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Nodal Admittance matrix $= \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -1 & 1 \\ 0 & 1 \end{bmatrix}$

10 A, 11 A, 1 A, 4 A

A6 (a) $\begin{bmatrix} 6 + j\,2 & 4 - j\,2 \\ 4 - j\,2 & 6 + j\,2 \end{bmatrix}\ \Omega$ (b) $\begin{bmatrix} 3.000\angle 15^0 \\ 0.000 \\ 3.000\angle 135^0 \end{bmatrix}$ A

A7 $0.1575 \sin(314.16t + 2.3^o) + 0.1384 \sin(3\times 314.16t - 172.7^o) + 0.1050 \sin(5\times 314.16t + 14.0^o) + 0.656 \sin(7\times 314.16t - 153.9^o) + \ldots\ldots$ A

Form factor = 2.3 (or 2.15 with approximations)

Peak factor = 2.72 (or 2.91 with approximations)

Power Consumed = 25.57 W

Overall power factor = 0.605 (or 0.674 with approximations)

A8 $\dfrac{E_m}{L\omega}\left[0.6e^{-0.333\omega t} - 0.1154e^{-0..666\omega t} + 0.7894\sin(\omega t - 37.87^o)\right]\ A$

$E_m\left[-0.2e^{-0.333\omega t} + 0.0769e^{-0..666\omega t} + 0.7894\cos(\omega t - 37.87^o)\right]\ V$