

ELEN20005 FOUNDATIONS OF ELECTRICAL NETWORKS

Semester 1 Exam, 2018

Numerical Answers

**Question 1**

(a)  $v_T = 15 \text{ V}$ ,  $R_T = 50 \text{ } \Omega$

(b)  $1 = \frac{v}{15 \text{ V}} + \frac{i}{0.3 \text{ A}}$

**Question 2**

(b)  $i = \frac{2}{7} \text{ A}$ ,  $v_1 = \frac{100}{7} \text{ V}$ ,  $v_2 = \frac{80}{7} \text{ V}$

(c)  $P = \frac{-100}{7} \text{ W} < 0$ , delivers power.

**Question 3**

(a)  $i_L(0^-) = -5 \text{ A}$  (b)  $i_L(0^+) = -5 \text{ A}$

(c)  $i_L(t) = -5e^{-500t} \text{ A}$

(d)  $v_R(t) = 25e^{-500t} \text{ V}$

(e)  $p_R(t) = 125e^{-1000t} \text{ W}$

(f) Brown/Black/Orange/Gold

**Question 4**

(a)  $T = 0.03$ ,  $P = 359.4 \text{ W}$ ,  $Q = 2.49 \text{ kVAR}$ ,  $R_c = 178 \text{ k}\Omega$ ,  $X_m = 25.6 \text{ k}\Omega$

(b)(ii)  $Q = 1.22 \text{ kVAR}$ ,  $R_{eq,1} = 43.2 \text{ } \Omega$ ,  $X_{eq,1} = 195.3 \text{ } \Omega$

(b)(iii)  $R_{eq,2} = 0.039 \text{ } \Omega$ ,  $X_{eq,2} = 0.176 \text{ } \Omega$

(b)(iv)  $Z_L = 0.039 - j0.176 \text{ } \Omega$ ,  $R = 0.039 \text{ } \Omega$ ,  $C = 15 \text{ mF}$

**Question 5**

(a)  $\mathbf{I}_L = 5.6 \angle -33.4^\circ \text{ Arms}$ ,  $\mathbf{I}_1 = 3.54 \angle -15^\circ \text{ Arms}$ ,  $\mathbf{I}_2 = 2.51 \angle -60^\circ \text{ Arms}$ .

(c)  $\theta_i = -25.5^\circ$

**Question 6**

(a)  $9.1 \text{ ms} \leq t \leq 41 \text{ ms}$

(b)  $i(t) = \begin{cases} \frac{1}{2}(11 \sin(20\pi t) - 6) \text{ A}, & \text{for } 9.1 \text{ ms} \leq t \leq 41 \text{ ms} \\ 0, & \text{otherwise} \end{cases}$

(c)  $Q = 51.8 \text{ mC}$

(d)  $Q_s = 518 \text{ mC}$

(e) 19.3 hours

**Question 8**

(a)  $Z_{line} = 10 + j5 \text{ } \Omega$

(b)  $\mathbf{V}_{BC} = 244 \angle -84.8^\circ \text{ V}$ ,  $\mathbf{I}_{BC} = 1.03 \angle -156.4^\circ \text{ A}$ ,

(c)  $P = 47.5 \text{ W}$ ,  $Q = 23.7 \text{ VAR}$