Q1.

(1) C
(2) D
(3) A
(4) B

Q2.

(a) 3 essential nodes
(b) 2, 3, 4/5/6
(c) 3 meshes
(d) One supermesh for nodes 2 and 3
(e) Using supermesh concept at Nodes 2 and 3, we have:

$$\begin{cases} I_1R_1 + (I_1 - I_2)R_2 + 5 = 0 \\ (I_2 - I_1)R_2 + I_3R_3 + 10 = 0 \\ i_x = I_1 - I_2 = I_3 - I_2 \end{cases}$$

$$\rightarrow \begin{cases} 5\,I_1 - I_2 = -0.005 \\ -I_1 + I_2 + 2I_3 = -0.010 \\ I_1 - I_3 = 0 \end{cases}$$

Or:

Without using supermesh concept, we can write 3 KVLs(assuming the voltage across dependent source is V_x.

$$\begin{cases} I_1R_1 + (I_1 - I_2)R_2 + 5 = 0 \\ (I_2 - I_1)R_2 - V_x + 10 = 0 \\ I_3R_3 + V_x = 0 \\ i_x = I_1 - I_2 = I_3 - I_2 \end{cases}$$

(f) i_x=5 mA

Q3.

(1) Equivalent inductance: 0.12mH
(2) Time constant: 6 μs
(3) Voltage between nodes “a” and “b”

$\mathrm{V(t)} = 40e^{-\frac{t\times10^6}{6}}\mathrm{V}$

(4) Power dissipated:

$$\mathrm{P} = 80e^{-\frac{t\times10^6}{3}}\mathrm{W}$$