Tutorial-6 Solutions

Ans. $l = 0.3\lambda$

(a) Reflection coefficient at the load

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{30 - 20j - 50}{30 - 20j + 50} = 0.343\angle$$

(b) $$SWR = \frac{1 + |\Gamma|}{1 - |\Gamma|} = \frac{1 + 0.343}{1 - 0.343} = 2.044$$

(c) $$Z_{in} = Z_0 \frac{Z_L + jZ_0 \tan\beta l}{Z_0 + jZ_L \tan\beta l}$$

$$= 50 \frac{30 - 20j + j50(-3.077)}{50 + j(30 - 20j)(-3.077)}$$

$$= 50 \frac{30 - 20j - 153.5j}{50 - 61.4 - 92.1j} = 90$$

(d) $$\Gamma_{in} = \frac{Z_{in} - Z_0}{Z_{in} + Z_0} = \frac{90.78 + 27.52j}{90.78 + 27.52}$$

$$\boxed{\Gamma_{in} = 0.343\angle 22.92^\circ}$$

Ans 2

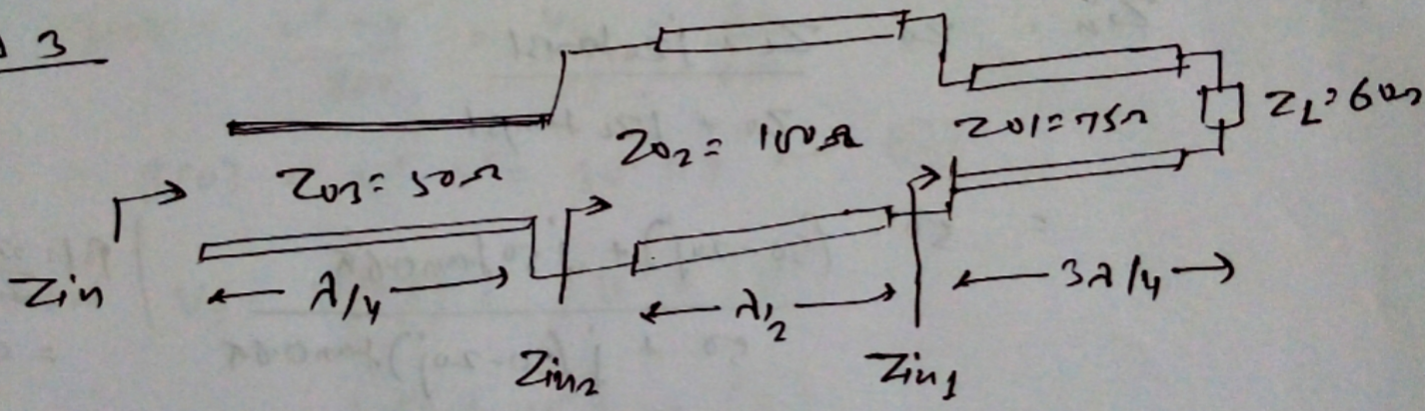
$$Z_{sc} = Z_{in}\Big|_{Z_L=0} = jZ_0 \tan\beta l \quad -①$$

$$Z_{oc} = Z_{in}\Big|_{Z_L=\infty} = -jZ_0 \cot\beta l \quad -②$$

Multiply ① and ②

$$\boxed{Z_{sc} \cdot Z_{oc} = Z_0^2}$$

Ans 3



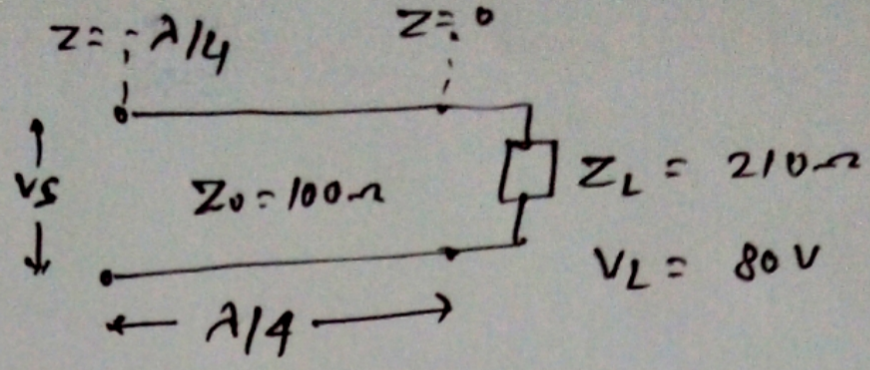
$$Z_{in1} = \frac{Z_{01}^2}{Z_L} = \frac{75\times75}{60} = 93.75\Omega$$

$$Z_{in2} = Z_{in1} = 93.75\Omega$$

$$Z_{in} = \frac{Z_{02}^2}{Z_{03}} = \frac{Z_{03}^2}{Z_{in_2}} = \frac{50\times50}{93.75} =$$

$$\boxed{Z_{in} = 26.67\Omega}$$

Ans 4



$V_S = ?$

$$V(z) = V^+ e^{-j\beta z} + V^- e^{j\beta z}$$

$$I(z) = \frac{V^+ e^{-j\beta z} - V^- e^{j\beta z}}{Z_0}$$

$$V(0) = V_L = V^+ + V^- = 80 \quad \longleftarrow (1)$$

$$I(0) = \frac{V^+ - V^-}{100} = \frac{V_L}{Z_L} = \frac{80}{210}$$

$$\therefore I(0) = V^+ - V^- = 38.09 \quad \longleftarrow (2)$$

Now $V_S = V\left(\frac{-\lambda}{4}\right) = jV^+ - jV^-$

$$V_S = j(V^+ - V^-) \quad - (3)$$

from (2) and (3)

$$V_S = 38.09j = 38.09\angle 90^\circ \text{ V}$$