COMMUNICATIONS I

SOLUTIONS TO PROBLEM SHEET NINE

1.

$$K_V = \frac{(Z_L - Z_0)}{Z_L + Z_0} = 0.2$$

$$V_- = K_V V_+ = 0.2V$$

$$I_- = -K_V I_+ = -K_V \frac{V_+}{Z_0} = -4mA$$

$$V_L = (1 + K_V) V_+ = 1.2V$$

$$I_L = (1 - K_V) I_+ = 16 mA$$

IF WE ADD A RESISTOR AT THE JUNCTION, THE NEW LOAD SEEN BY THE 50Ω LINE IS $R \cdot Z_L / (R + Z_L)$. WE WANT THIS NEW LOAD TO BE EQUAL TO 50Ω (MATCHED LINES). THEREFORE R = 150Ω.

2.

(a) $Z_0 = 50\,\Omega$

$u = 2 \cdot 10^8$ m/sec

(b) $$Z_{IN} = Z_0 \left[\frac{Z_L + j Z_0 \tan kL}{Z_0 + j Z_L \tan kL} \right]$$

LINE 1 $\quad Z_L = +\infty$

THUS $$Z_{IN} = \frac{Z_0}{j \tan kL}$$

LINE 2 $\quad Z_L = 0$

THUS $\quad Z_{IN} = j Z_0 \tan kL$

COMBINING IN SERIES

$$Z_{ab} = Z_0 \left(\frac{1}{j \tan kL} + j \tan kL \right) + Z_0 = 50\,\Omega$$

$$\Rightarrow j Z_0 \left(\tan kL - \frac{1}{\tan kL} \right) = 0$$

$$\Rightarrow \tan kL = \frac{1}{\tan kL} = 1 \Rightarrow kL = \pi/4$$

THUS

$$L = \frac{\pi}{4K} = \frac{\pi}{4} \cdot \frac{2 \cdot 10^8}{2\pi \cdot 10^6} = 25\,m$$