1. For the ribbon cable shown below, assume the total mutual inductance and mutual capacitance to be \( L_m = 0.4 \mu H \) and \( c_m = 400 \text{pF} \). If \( V_S(t) \) is a 1 MHz sinusoid of magnitude 1 V, and the termination impedances are \( R_s = R_L = R_{NE} = R_{FE} = 50\Omega \).

   a) Determine the near-end crosstalk if a shield is placed around the receptor wire and the shield is only connected to the near end of the reference wire.

   b) How much does the shield reduce the crosstalk?

2. We can model the shield on a 2-m personal computer printer cable as a monopole antenna (with the metallic structure of the computer as the ground plane). If the voltage of the shield attachment point with respect to the metallic structure is a 1-mV, 37.5-MHz signal, estimate the maximum radiated emissions at a measurement distance of 3 m.

3. Compute the reflection loss and absorption loss for a 20 mil steel (SAE 1045) barrier at 30 MHz, 100 MHz, and 1 GHz, assuming a far-field source.

4. Compute the reflection loss and absorption loss for a 20-mil steel (SAE 1045) barrier at 10 kHz, 100 kHz, and 1 MHz for a near-field electric source that is a distance of 5 cm from the shield. Repeat for a near-field magnetic source.

5. Determine the length of a waveguide to provide 100 dB attenuation if the guide dimensions are 100 × 100 mils. What range of frequencies are attenuated by this guide (at least in the waveguide propagation mode)?