1. Express the voltages of the following in dB V and in dB mV:

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* 1. 240 V r.m.s. mains voltage
  2. the peak mains voltage
  3. the voltage across a 50  resistor, in which flows a current of 20 A.

1. FIGURE 1 shows two circuits. In one circuit, a 100 kHz signal source with an EMF of 2 V r.m.s., supplies a 1 k load. The capacitance between the signal conductors in the two circuits is 250 pF. The signal source and load resistances in the other circuit are 1 k and 2 k, respectively. Each of the signal conductors has a 50 pF capacitance to ground.
2. Plot the frequency characteristic of the crosstalk voltage.
3. Determine the crosstalk voltage across the load in the second circuit at the following frequencies:
   1. 100 Hz
   2. 1 kHz
   3. 1 MHz
4. Suggest four ways of reducing capacitive crosstalk between circuits.

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*RL1*



1. *k*

*RL2*

1. *k*

*50 pF 250 pF*

*50 pF*

*R2 1 k*

*Vs 2 V*

FIG. 1

1. The mutual inductance between the two circuits shown in FIGURE 2 is

0.2 H. It may be assumed that (*R*1 + *RL*1) >> *L*1 and that (*R*2 + *RL*2) >>

*L*2.

1. Estimate the crosstalk voltage at the load of circuit B when the signal source of circuit A is *V*1 = 1 V at 1 GHz.
2. Plot the crosstalk voltage (at the load of circuit B) as a function of frequency.
3. Suggest three ways of reducing inductive crosstalk.

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*RL1*



*L1*

*A 0.2* *H*

*50* 

*L2*

*B*

*RL2*

*3.3 k*

*R1 50*  *R2 1 k*

*V1 1 V r.m.s.*

FIG. 2

1. A circuit supplies a 'square' current waveform, with a peak value of 25 mA and transition times of 10 ns, as shown in FIGURE 3. The ground return conductor has a resistance of 50 m and an inductance of 100 nH.
   1. Determine the maximum voltage drop along the ground conductor.
   2. Sketch the waveform of the voltage which will appear along the ground conductor.
   3. How would you reduce the ground conductor impedance in practical circuits?

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*i 25 mA*

*10 ns*

*10 ns*

*t*

FIG. 3

1. At 1 kHz, the skin depth in copper is 2 mm. Determine the a.c. resistance at 500 kHz and at 10 MHz of 20 cm lengths of copper conductors having the following cross sections:
   1. round section 20 mm2
   2. square section 20 mm2
   3. rectangular section 1 mm  20 mm

Take the conductivity of copper as 5.8  107 Sm–1 Comment on the results.

1. FIGURES 4(a) and 4(b) show the equivalent circuits of filters used with a signal source which has an output resistance of 50 .

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* 1. Identify the types of filters and determine the insertion loss for each of them, at 100 kHz and at 1 MHz, when used with
     1. a 50  load
     2. a 1 k load.
  2. Plot the insertion loss of each filter as a function of frequency when used with a 50  load.

*100 mH*



*33* *F*



* 1. (b)

FIGS. 4(a) and 4(b)