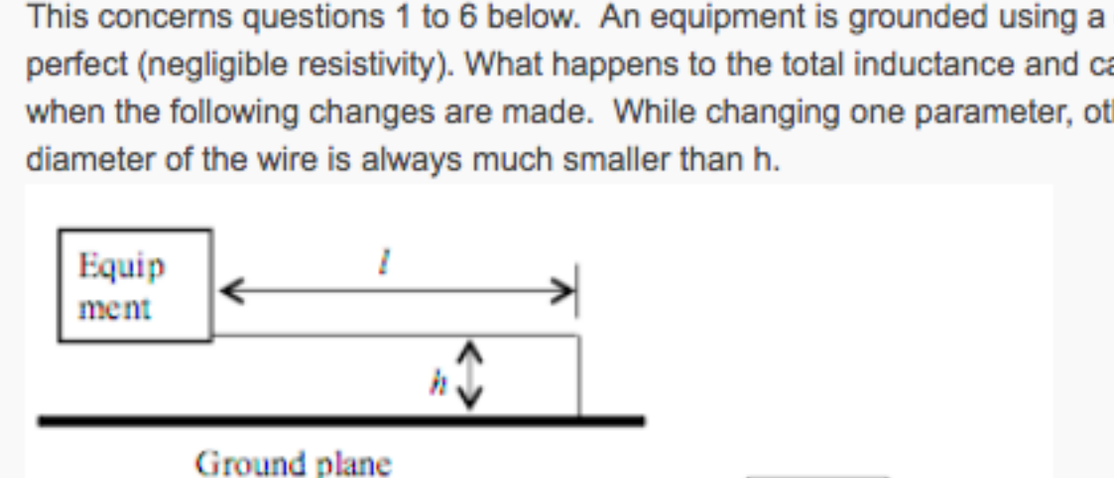
Unit 4 - Week 3

Assignment 3

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-03-20, 23:59 IST.

Non-ideal behaviour of components (Module 3.1 to Module 3.3)
This concerns questions 1 to 6 below. An equipment is grounded using a conducting wire made of copper as shown in Fig. 1. Assume the ground plane to be perfect (negligible resistivity). What happens to the total inductance and capacitance (say if each of them increase or decrease or do not change) of the wire when the following changes are made. While changing one parameter, other parameters are kept constant. Length l is much greater than h in all cases and diameter of the wire is always much smaller than h.



1) Decrease length of wire l. *1 point*

- Inductance decreases, capacitance increases
- Inductance increases, capacitance decreases
- Inductance increases, capacitance increases
- Inductance decreases, capacitance decreases

No, the answer is incorrect.
Score: 0
Accepted Answers:
Inductance decreases, capacitance decreases

2) Decrease height h of the wire above ground plane. *1 point*

- Inductance decreases, capacitance increases
- Inductance increases, capacitance decreases
- Inductance increases, capacitance increases
- Inductance decreases, capacitance decreases

No, the answer is incorrect.
Score: 0
Accepted Answers:
Inductance decreases, capacitance increases

3) Increase the surface area of the wire. *1 point*

- Inductance decreases, capacitance increases
- Inductance increases, capacitance decreases
- Inductance increases, capacitance increases
- Inductance decreases, capacitance decreases

No, the answer is incorrect.
Score: 0
Accepted Answers:
Inductance decreases, capacitance increases

4) Increase the frequency of the signal carried by the wire. *1 point*

- Inductance decreases, capacitance increases
- Inductance increases, capacitance decreases
- Inductance increases, capacitance increases
- Inductance decreases, capacitance unchanged

No, the answer is incorrect.
Score: 0
Accepted Answers:
Inductance decreases, capacitance unchanged

5) Insert an infinite dielectric of thickness h between the wire and ground plane. *1 point*

- Inductance decreases, capacitance increases
- Inductance increases, capacitance decreases
- Inductance unchanged, capacitance increases
- Inductance decreases, capacitance decreases

No, the answer is incorrect.
Score: 0
Accepted Answers:
Inductance unchanged, capacitance increases

6) Use a ferromagnetic material, instead of copper, for the wire. *1 point*

- Inductance decreases, capacitance increases
- Inductance increases, capacitance unchanged
- Inductance increases, capacitance increases
- Inductance decreases, capacitance decreases

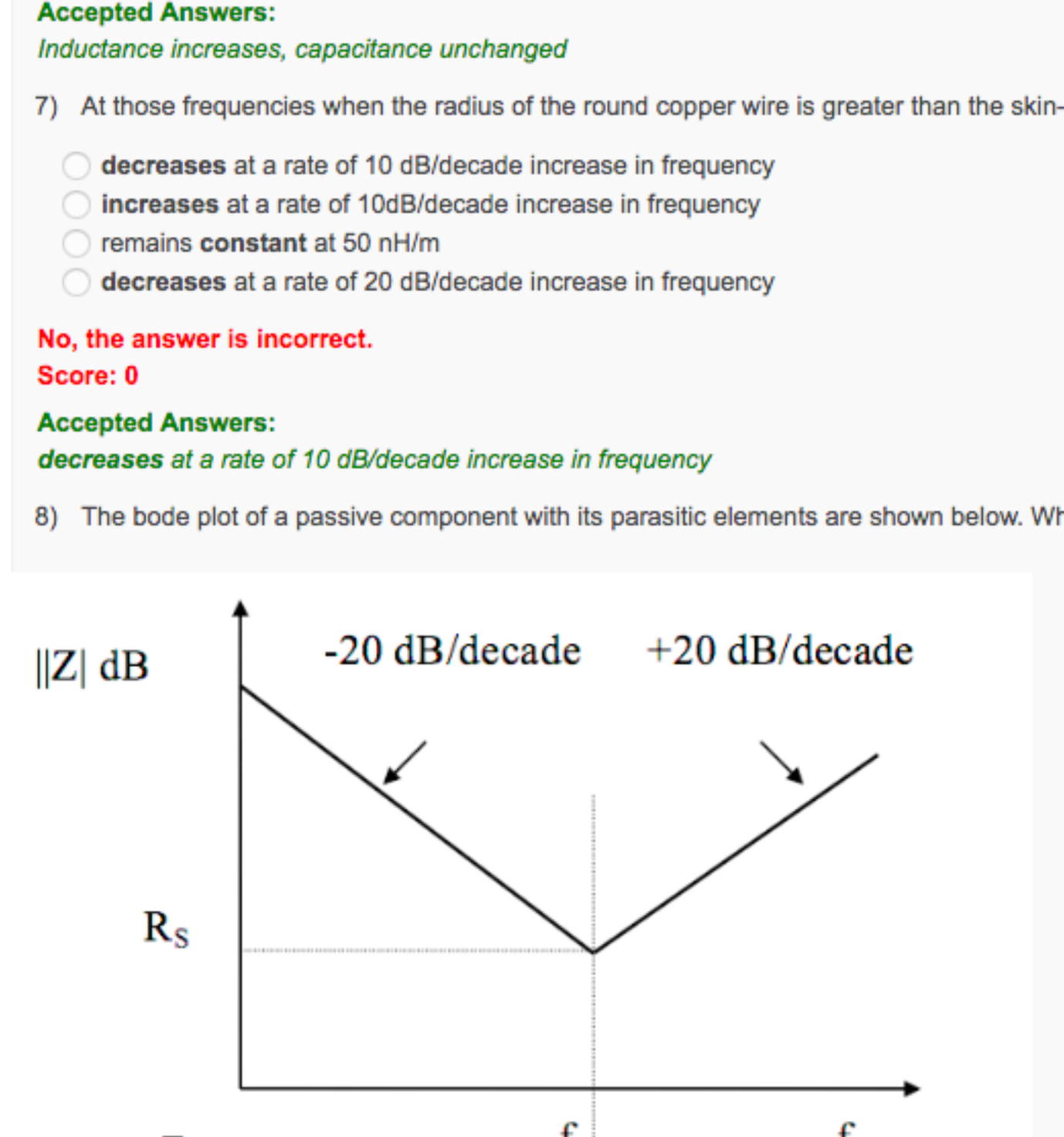
No, the answer is incorrect.
Score: 0
Accepted Answers:
Inductance increases, capacitance unchanged

7) At those frequencies when the radius of the round copper wire is greater than the skin-depth, the per unit length internal inductance of the wire *1 point*

- **decreases** at a rate of 10 dB/decade increase in frequency
- **increases** at a rate of 10dB/decade increase in frequency
- remains **constant** at 50 nH/m
- **decreases** at a rate of 20 dB/decade increase in frequency

No, the answer is incorrect.
Score: 0
Accepted Answers:
***decreases** at a rate of 10 dB/decade increase in frequency*

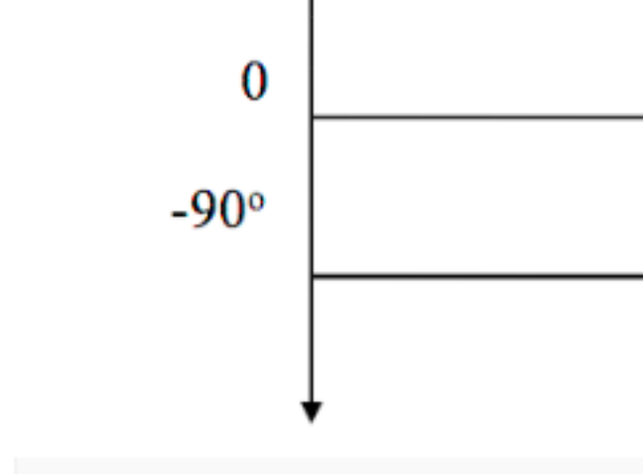
8) The bode plot of a passive component with its parasitic elements are shown below. Which is that component *1 point*



- an inductor
- a resistor of very low value
- a capacitor
- a resistor of very high value.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a capacitor

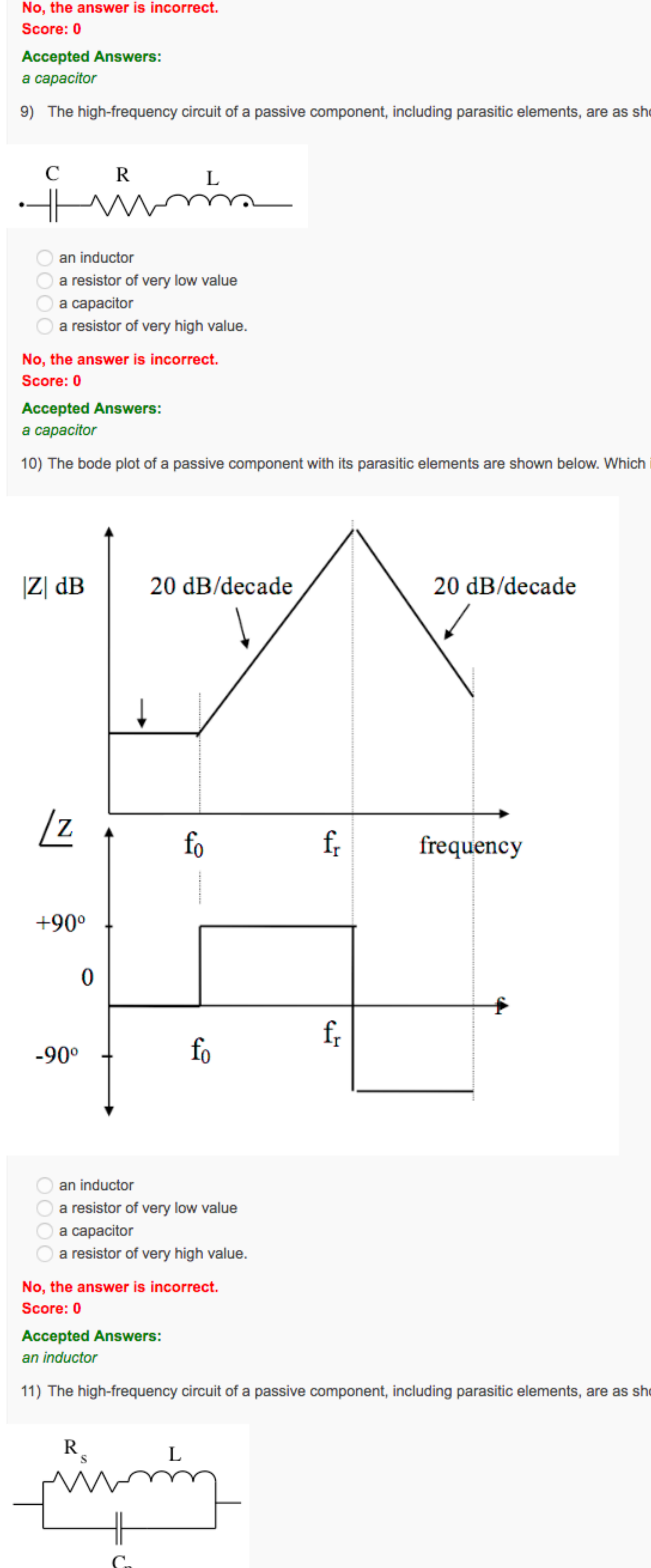
9) The high-frequency circuit of a passive component, including parasitic elements, are as shown. Which is that component? *1 point*



- an inductor
- a resistor of very low value
- a capacitor
- a resistor of very high value.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a capacitor

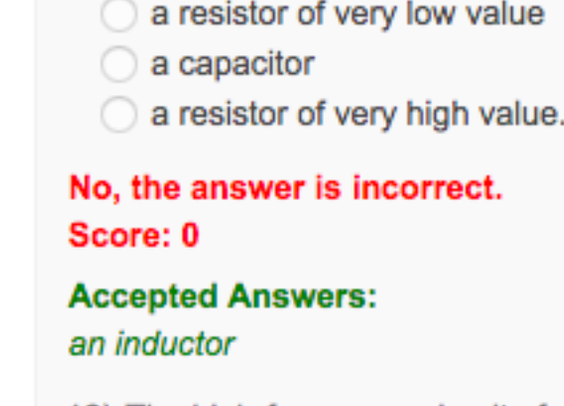
10) The bode plot of a passive component with its parasitic elements are shown below. Which is that component? *1 point*



- an inductor
- a resistor of very low value
- a capacitor
- a resistor of very high value.

No, the answer is incorrect.
Score: 0
Accepted Answers:
an inductor

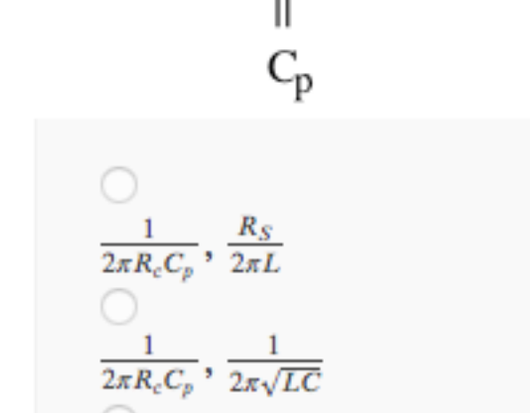
11) The high-frequency circuit of a passive component, including parasitic elements, are as shown. Which is that component? *1 point*



- an inductor
- a resistor of very low value
- a capacitor
- a resistor of very high value.

No, the answer is incorrect.
Score: 0
Accepted Answers:
an inductor

12) The high-frequency circuit of a passive component, including parasitic elements, are as shown. As the frequency is increased starting from zero, identify the two corner frequencies in the bode-plot between which the component behaves as a true inductor. *1 point*



- $\frac{1}{2\pi R_s C_p}, \frac{R_S}{2\pi L}$
- $\frac{1}{2\pi R_s C_p}, \frac{1}{2\pi\sqrt{LC}}$
- $\frac{R_S}{2\pi L}, \frac{1}{2\pi\sqrt{LC}}$
- $\frac{R_S}{2\pi L}, \frac{1}{2\pi R_s C_p}$

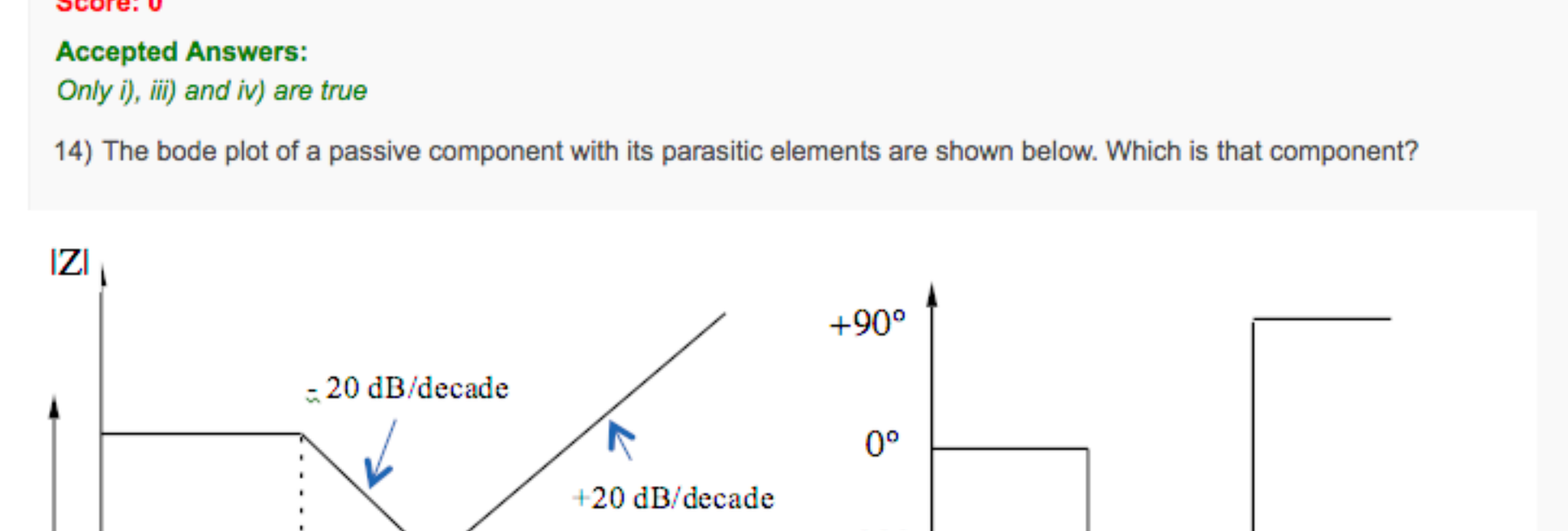
No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{R_S}{2\pi L}, \frac{1}{2\pi\sqrt{LC}}$

13) There are some practical considerations in the use of inductors for suppressing noise currents. Identify all **true** statements among the following. *1 point*
i) Make sure that the noise frequencies are **below** the self-resonant frequency of the inductor
ii) Make sure that the noise frequencies are **above** the self-resonant frequency of the inductor
iii) Make sure to avoid the possibility of "ringing" due to resonance formed by parallel or series (parasitic) capacitance of the circuit.
iv) Best suited to be used in **series** for blocking noise in the **low-impedance** circuits.
v) Best suited to be used in **parallel** for shunting noise in the **high-impedance** circuits.
vi) Best suited to be used in **series** for blocking the noise in the **high-impedance** circuits.
vii) Best suited to be used in **parallel** for shunting noise in the **low-impedance** circuits.

- Only i) iii) and vii) are true
- Only ii) iii) and vi) are true
- Only i), iii) and iv) are true
- Only i), iii) and v) are true

No, the answer is incorrect.
Score: 0
Accepted Answers:
Only i), iii) and iv) are true

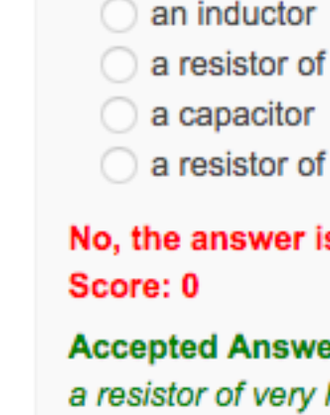
14) The bode plot of a passive component with its parasitic elements are shown below. Which is that component? *1 point*



- an inductor
- a resistor of very low value
- a capacitor
- a resistor of very high value.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a resistor of very high value.

15) The high-frequency circuit of a passive component, including parasitic elements, are as shown. As the frequency is increased starting from zero, identify the two possible corner frequencies in the bode-plot. *1 point*



- $\frac{1}{2\pi RC_p}, \frac{1}{2\pi\sqrt{L_{wc}C_p}}$
- $\frac{R}{2\pi L_{wc}}, \frac{1}{2\pi\sqrt{L_{wc}C_p}}$
- $\frac{1}{2\pi RC_p}, \frac{R}{2\pi L_{wc}}$
- $\frac{1}{2\pi\sqrt{L_{wc}C_p}}, \frac{R}{2\pi L_{wc}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{1}{2\pi RC_p}, \frac{1}{2\pi\sqrt{L_{wc}C_p}}$

16) To measure accurately the high-frequency currents in a circuit, the voltage across a very low value resistor or 'measurement shunt' (fraction of an Ohm resistance value) connected in series with the circuit is often measured as proportional to the current in the circuit. To get better accuracy over a larger frequency-range, often larger value resistors are connected in parallel (without increasing the component lead lengths) to get the desired 'shunt' value. From below, give the logic behind connecting several resistors in parallel to get the desired 'measurement shunt' value and increased frequency range for accurate measurements. *1 point*

- Several parallel connections bring in **parasitic capacitors in parallel** influencing the **resonant frequency**.
- Several parallel connections bring in **parasitic inductors in parallel** influencing the **resonant frequency**.
- Several parallel connections bring in **parasitic capacitors in parallel** increasing the **frequency of transition** from resistance to capacitance behaviour.
- Several parallel connections bring in **parasitic inductors in parallel** increasing the **frequency of transition** from resistance to inductance behaviour.

No, the answer is incorrect.
Score: 0
Accepted Answers:
*Several parallel connections bring in **parasitic inductors in parallel** increasing the **frequency of transition** from resistance to inductance behaviour.*

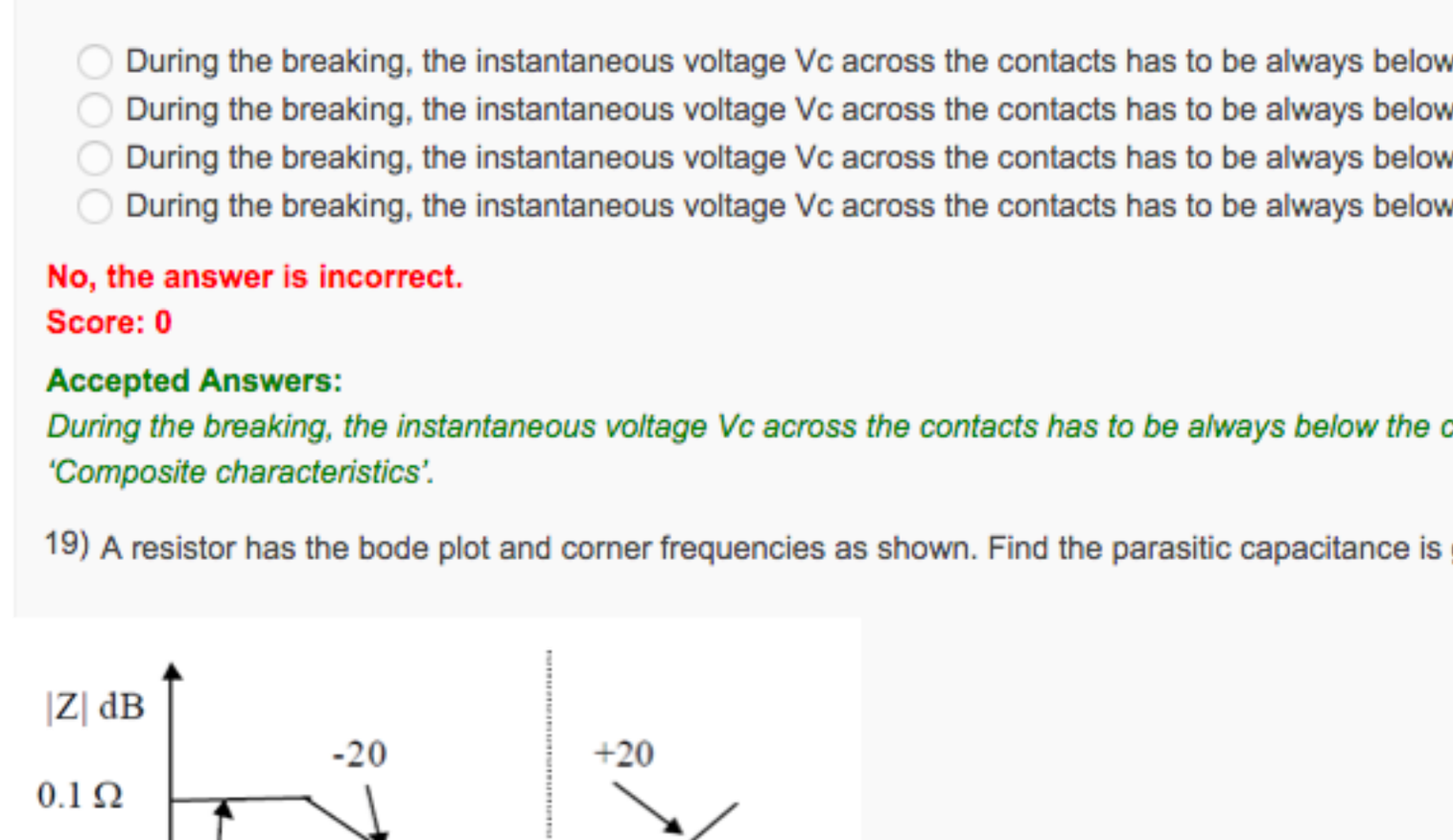
17) There are some practical considerations in the use of capacitors for suppressing noise currents. Identify all true statements among the following. *1 point*

i) Make sure that the noise frequencies are below the self-resonant frequency of the capacitor.
ii) Make sure that the noise frequencies are above the self-resonant frequency of the capacitor.
iii) In low-amplitude signal applications, the capacitor should not be placed in such a way so that it forms a loop with other components serving as a receiving antenna for radiated electromagnetic Interference.
iv) Capacitor in parallel with the inductance of the cable it is protecting can form a parallel L-C circuit and can produce "ringing" due to resonance.
v) Best suited to be used in series for blocking the noise in the low-impedance circuits.
vi) Best suited to be used in parallel for shunting noise in the high-impedance circuits.
vii) Best suited to be used in series for blocking the noise in the high-impedance circuits.
viii) Best suited to be used in parallel for shunting noise in the low-impedance circuits.

- Only i) iii), iv) and vii) are true
- Only ii) iii), iv) and vi) are true
- Only i), iii), iv) and v) are true
- Only i), iii), iv) and viii) are true

No, the answer is incorrect.
Score: 0
Accepted Answers:
Only ii) iii), iv) and vi) are true

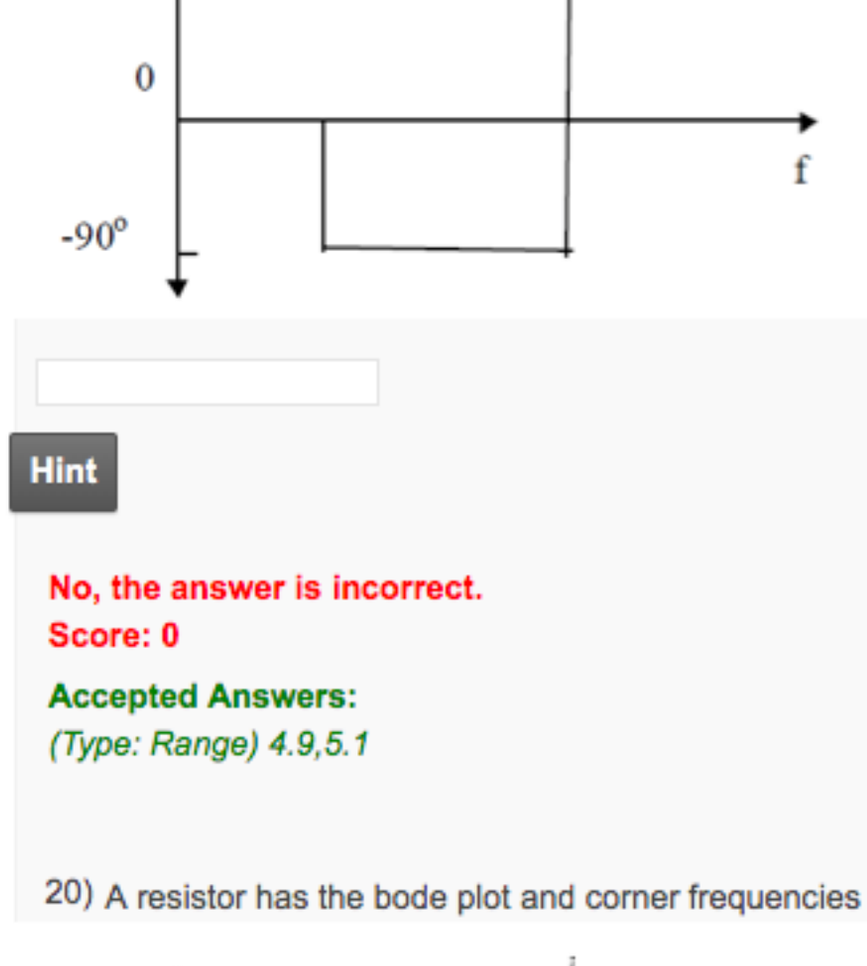
18) The relationship between the voltage across the contacts and the distance between the contacts governing the contact breakdown is shown in the figure below. Under what condition described below can one ensure contact breaking without any 'sparking' and associated high-frequency noise. *1 point*



- During the breaking, the instantaneous voltage Vc across the contacts has to be always below the curve 'Glow Discharge breakdown'.
- During the breaking, the instantaneous voltage Vc across the contacts has to be always below the curve 'Arc Discharge breakdown'.
- During the breaking, the instantaneous voltage Vc across the contacts has to be always below the curve 'Composite characteristics'.
- During the breaking, the instantaneous voltage Vc across the contacts has to be always below the curve 'Arc discharge sustaining voltage'.

No, the answer is incorrect.
Score: 0
Accepted Answers:
During the breaking, the instantaneous voltage Vc across the contacts has to be always below the curve 'Composite characteristics'.

19) A resistor has the bode plot and corner frequencies as shown. Find the parasitic capacitance is given by____x10^{-9} F

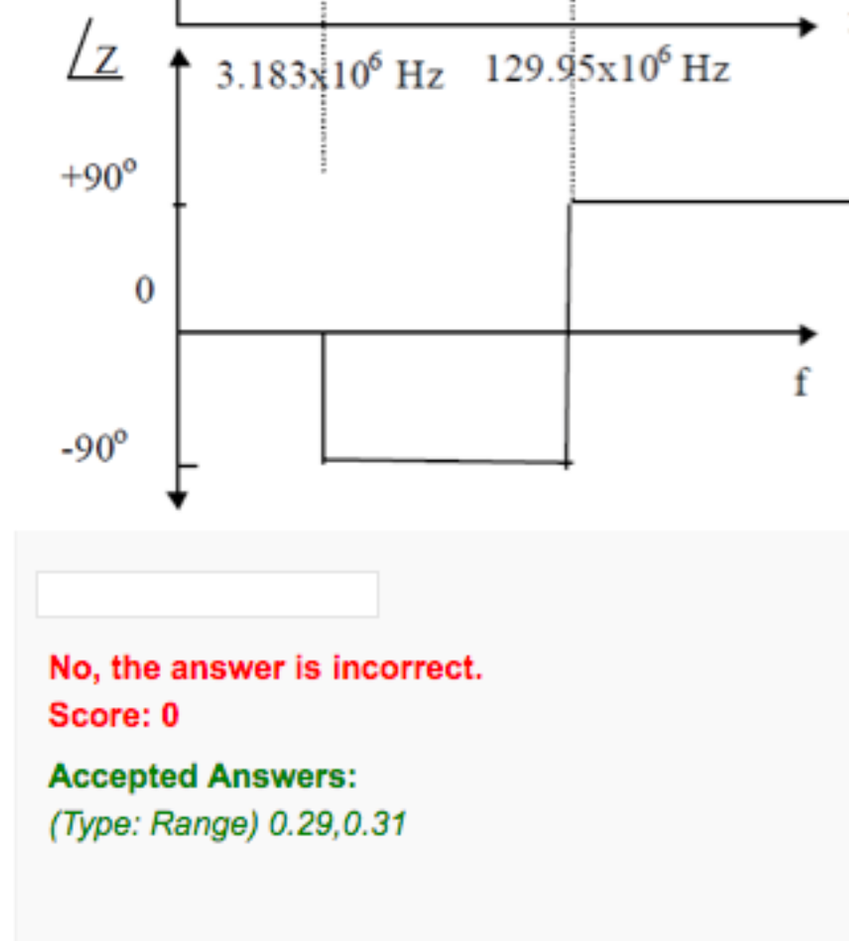


Hint

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 4.9,5.1

0 points

20) A resistor has the bode plot and corner frequencies as shown. Find the parasitic inductance are given by ___X 10^{-9} H.



No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.29,0.31

0 points

21) Find the resistance of a round wire of radius 2 mm made of Iron ($\sigma_iron = 0.58x10^7$ S/m, μ_r=500) at 1000 Hz. Resistance is ____ Ω/m

Hint

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.044,0.048

1 point

22) Find the internal inductance of a round wire of radius 2 mm made of Iron ($\sigma_iron = 0.58x10^7$ S/m, μ_r=500) at 1000 Hz. internal inductance is ____ X10^{-6}H/m

Hint

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 7.2,7.6

1 point

Previous Page End