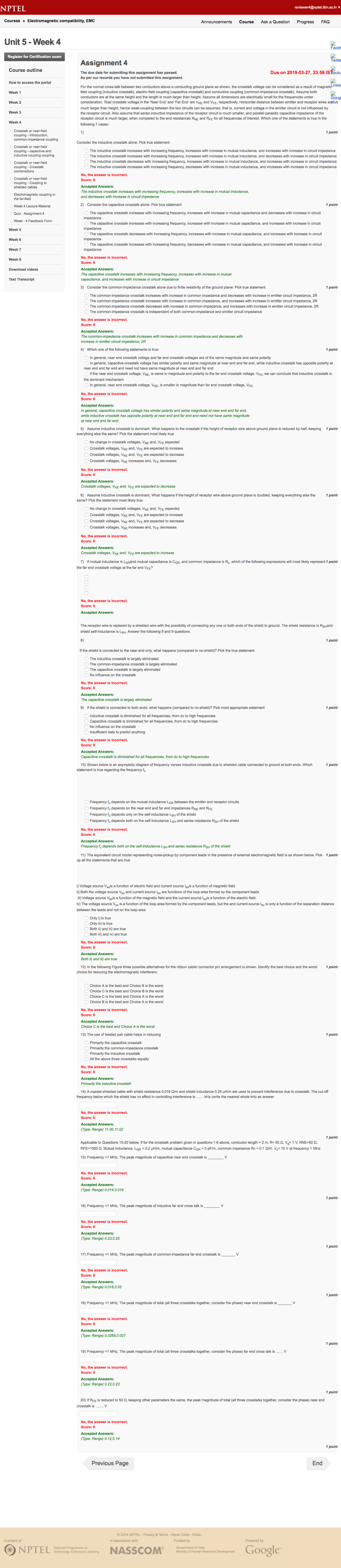

Unit 5 - Week 4

Register for Certification exam

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Assignment 4

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

Due on 2019-03-27, 23:59 IST.

For the normal cross-talk between two conductors above a conducting ground plane as shown, the crosstalk voltage can be considered as a result of magnetic field coupling (inductive crosstalk), electric field coupling (capacitive crosstalk) and conductive coupling (common-impedance crosstalk). Assume both conductors are at the same height and the length is much larger than height. Assume all dimensions are electrically small for the frequencies under consideration. Total crosstalk voltage in the 'Near End' and 'Far End' are V_{NE} and V_{FE}, respectively. Horizontal distance between emitter and receptor wires are much larger than height, hence weak-coupling between the two circuits can be assumed, that is, current and voltage in the emitter circuit is not influenced by the receptor circuit. Also assume that series inductive impedance of the receptor circuit is much smaller, and parallel parasitic capacitive impedance of the receptor circuit is much larger, when compared to the end resistances R_{NE} and R_{FE} for all frequencies of interest. Which one of the statements is true in the following 7 cases:

1) *1 point*

Consider the inductive crosstalk alone: Pick true statement

○ The inductive crosstalk increases with increasing frequency, increases with increase in mutual inductance, and increases with increase in circuit impedance
○ The inductive crosstalk increases with increasing frequency, increases with increase in mutual inductance, and decreases with increase in circuit impedance
○ The inductive crosstalk decreases with increasing frequency, increases with increase in mutual inductance, and increases with increase in circuit impedance
○ The inductive crosstalk increases with increasing frequency, decreases with increase in mutual inductance, and increases with increase in circuit impedance

No, the answer is incorrect.
Score: 0

Accepted Answers:
The inductive crosstalk increases with increasing frequency, increases with increase in mutual inductance, and decreases with increase in circuit impedance

2) Consider the capacitive crosstalk alone: Pick true statement *1 point*

○ The capacitive crosstalk increases with increasing frequency, increases with increase in mutual capacitance and decreases with increase in circuit impedance
○ The capacitive crosstalk increases with increasing frequency, increases with increase in mutual capacitance, and increases with increase in circuit impedance
○ The capacitive crosstalk decreases with increasing frequency, increases with increase in mutual capacitance, and increases with increase in circuit impedance
○ The capacitive crosstalk increases with increasing frequency, decreases with increase in mutual capacitance, and increases with increase in circuit impedance

No, the answer is incorrect.
Score: 0

Accepted Answers:
The capacitive crosstalk increases with increasing frequency, increases with increase in mutual capacitance, and increases with increase in circuit impedance

3) Consider the common-impedance crosstalk alone due to finite resistivity of the ground plane: Pick true statement *1 point*

○ The common-impedance crosstalk increases with increase in common impedance and decreases with increase in emitter circuit impedance, 2R
○ The common-impedance crosstalk increases with increase in common-impedance, and increases with increase in emitter circuit impedance, 2R
○ The common-impedance crosstalk decreases with increase in common-impedance, and increases with increase in emitter circuit impedance, 2R
○ The common-impedance crosstalk is independent of both common-impedance and emitter circuit impedance

No, the answer is incorrect.
Score: 0

Accepted Answers:
The common-impedance crosstalk increases with increase in common impedance and decreases with increase in emitter circuit impedance, 2R

4) Which one of the following statements is true: *1 point*

○ In general, near end crosstalk voltage and far end crosstalk voltages are of the same magnitude and same polarity
○ In general, capacitive crosstalk voltage has similar polarity and same magnitude at near end and far end, while inductive crosstalk has opposite polarity at near end and far end and need not have same magnitude at near end and far end
○ If the near end crosstalk voltage, V_{NE}, is same in magnitude and polarity to the far end crosstalk voltage, V_{FE}, we can conclude that inductive crosstalk is the dominant mechanism
○ In general, near end crosstalk voltage, V_{NE}, is smaller in magnitude than far end crosstalk voltage, V_{FE}.

No, the answer is incorrect.
Score: 0

Accepted Answers:
In general, capacitive crosstalk voltage has similar polarity and same magnitude at near end and far end, while inductive crosstalk has opposite polarity at near end and far end and need not have same magnitude at near end and far end

5) Assume inductive crosstalk is dominant. What happens to the crosstalk if the height of receptor wire above ground plane is reduced by half, keeping everything else the same? Pick the statement most likely true *1 point*

○ No change in crosstalk voltages, V_{NE} and, V_{FE} expected
○ Crosstalk voltages, V_{NE} and, V_{FE} are expected to increase
○ Crosstalk voltages, V_{NE} and, V_{FE} are expected to decrease
○ Crosstalk voltages, V_{NE} increases and, V_{FE} decreases

No, the answer is incorrect.
Score: 0

Accepted Answers:
Crosstalk voltages, V_{NE} and, V_{FE} are expected to decrease

6) Assume inductive crosstalk is dominant. What happens if the height of receptor wire above ground plane is doubled, keeping everything else the same? Pick the statement most likely true *1 point*

○ No change in crosstalk voltages, V_{NE} and, V_{FE} expected
○ Crosstalk voltages, V_{NE} and, V_{FE} are expected to increase
○ Crosstalk voltages, V_{NE} and, V_{FE} are expected to decrease
○ Crosstalk voltages, V_{NE} increases and, V_{FE} decreases

No, the answer is incorrect.
Score: 0

Accepted Answers:
Crosstalk voltages, V_{NE} and, V_{FE} are expected to increase

7) If mutual inductance is $L_{GR}$and mutual capacitance is C_{GR}, and common impedance is R_c, which of the following expressions will most likely represent the far end crosstalk voltage at the far end V_{FE}? *1 point*

○
○
○
○

No, the answer is incorrect.
Score: 0

Accepted Answers:

The receptor wire is replaced by a shielded wire with the possibility of connecting any one or both ends of the shield to ground. The shield resistance is $R_{SH}$and shield self-inductance is L_{SH}. Answer the following 8 and 9 questions.

8) *1 point*

If the shield is connected to the near-end only, what happens (compared to no-shield)? Pick the true statement

○ The inductive crosstalk is largely eliminated
○ The common-impedance crosstalk is largely eliminated
○ The capacitive crosstalk is largely eliminated
○ No influence on the crosstalk

No, the answer is incorrect.
Score: 0

Accepted Answers:
The capacitive crosstalk is largely eliminated

9) If the shield is connected to both ends, what happens (compared to no-shield)? Pick most appropriate statement *1 point*

○ Inductive crosstalk is diminished for all frequencies, from dc to high frequencies
○ Capacitive crosstalk is diminished for all frequencies, from dc to high frequencies
○ No influence on the crosstalk
○ Insufficient data to predict anything

No, the answer is incorrect.
Score: 0

Accepted Answers:
Capacitive crosstalk is diminished for all frequencies, from dc to high frequencies

10) Shown below is an asymptotic diagram of frequency verses inductive crosstalk due to shielded cable connected to ground at both ends. Which statement is true regarding the frequency f_c *1 point*

○ Frequency f_c depends on the mutual inductance L_{GR} between the emitter and receptor circuits
○ Frequency f_c depends on the near end and far end impedances R_{NE} and R_{FE}
○ Frequency f_c depends only on the self-inductance L_{SH} of the shield
○ Frequency f_c depends both on the self-inductance L_{SH} and series resistance R_{SH} of the shield

No, the answer is incorrect.
Score: 0

Accepted Answers:
Frequency f_c depends both on the self-inductance L_{SH} and series resistance R_{SH} of the shield

11) The equivalent circuit model representing noise-pickup by component leads in the presence of external electromagnetic field is as shown below. Pick up all the statements that are true *1 point*

i) Voltage source $V_{so}$is a function of electric field and current source $I_{so}$is a function of magnetic field
ii) Both the voltage source V_{so} and current source I_{so} are functions of the loop area formed by the component leads
iii) Voltage source $V_{so}$is a function of the magnetic field and the current source $I_{so}$is a function of the electric field.
iv) The voltage source V_{so} is a function of the loop area formed by the component leads, but the and current source I_{so} is only a function of the separation distance between the leads and not on the loop area

○ Only i) is true
○ Only iii) is true
○ Both ii) and iii) are true
○ Both iii) and iv) are true

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both ii) and iii) are true

12) In the following Figure three possible alternatives for the ribbon cable/ connector pin arrangement is shown. Identify the best choice and the worst choice for reducing the electromagnetic interferenc *1 point*

○ Choice A is the best and Choice B is the worst
○ Choice C is the best and Choice B is the worst
○ Choice C is the best and Choice A is the worst
○ Choice B is the best and Choice A is the worst

No, the answer is incorrect.
Score: 0

Accepted Answers:
Choice C is the best and Choice A is the worst

13) The use of twisted pair cable helps in reducing *1 point*

○ Primarily the capacitive crosstalk
○ Primarily the common-impedance crosstalk
○ Primarily the inductive crosstalk
○ All the above three crosstalks equally

No, the answer is incorrect.
Score: 0

Accepted Answers:
Primarily the inductive crosstalk

14) A coaxial shielded cable with shield resistance 0.018 Ω/m and shield inductance 0.26 μH/m are used to prevent interference due to crosstalk. The cut-off frequency below which the shield has no effect in controlling interference is …… kHz (write the nearest whole kHz as answer

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 11.00,11.02

1 point

Applicable to Questions 15-20 below. If for the crosstalk problem given in questions 1-6 above, conductor length = 2 m, R= 50 Ω, V_g= 1 V, RNE=50 Ω, RFE=1000 Ω, Mutual inductance, L_{GR} = 0.2 μH/m, mutual capacitance C_{GR} = 5 pF/m, common impedance Rc = 0.1 Ω/m. V_s= 10 V at frequency 1 MHz

15) Frequency =1 MHz, The peak magnitude of capacitive near end crosstalk is ________ V

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.014,0.016

1 point

16) Frequency =1 MHz, The peak magnitude of inductive far end cross talk is ________ V

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.23,0.25

1 point

17) Frequency =1 MHz, The peak magnitude of common-impedance far end crosstalk is _______ V

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.018,0.02

1 point

18) Frequency =1 MHz, The peak magnitude of total (all three crosstalks together, consider the phase) near end crosstalk is _______ V

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.0269,0.027

1 point

19) Frequency =1 MHz, The peak magnitude of total (all three crosstalks together, consider the phase) far end cross talk is …… V

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.22,0.23

1 point

20) If R_{FE} is reduced to 50 Ω, keeping other parameters the same, the peak magnitude of total (all three crosstalks together, consider the phase) near end crosstalk is ……. V

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.12,0.14

1 point

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