# Unit 7 - Week 6

Register for Certification exam

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## Assignment 6

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

**Due on 2019-04-10, 23:59 IST.**

1) All practical cable shields will have some leakage of electromagnetic fields to the inside. A quantity used to define this leakage is 'Transfer Impedance.' Which of the following statements is true regarding transfer impedance for a braided-shield cable? ***1 point***

○ Transfer impedance is only inductive and represents magnetic field penetration through holes and gaps in the shield
○ Transfer impedance is only capacitive and represents electric field penetration through holes and gaps in the shield
○ Transfer impedance is only diffusive and represents current diffusion through the thickness of the shield to the inside
○ Transfer impedance is a combination of inductive and diffusive

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Transfer impedance is a combination of inductive and diffusive*

2) All practical cable shields will have some leakage of electromagnetic fields to the inside. A quantity used to define this leakage is 'Transfer Impedance.' Which one of the following statements is true regarding transfer impedance of a solid homogeneous tubular shield at low frequencies? ***1 point***

○ Transfer impedance **increases** with **increasing thickness** of shield, and **increasing conductivity** of shield material
○ Transfer impedance **decreases** with **increasing thickness** of shield, and **increasing conductivity** of shield material
○ Transfer impedance **does not depend on the shield thickness**, but **depend only on conductivity** of shield material
○ Transfer impedance **decreases** with **increasing thickness** of shield, and **decreasing conductivity** of shield material

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Transfer impedance **decreases** with **increasing thickness** of shield, and **increasing conductivity** of shield material*

3) A radio communication tower 50 meter tall is struck by lightning. The antenna is placed at the top of the tower and the electronics at the base of the tower. A cable with braided copper shield connects the electronics with the antenna. It is estimated that about 60 % of the lightning current will be flowing through the cable shield and the shield is estimated to have a low-frequency resistance of 2 milli-ohms/meter and leakage inductance of 3 nano-henrys/meter. The lightning current has a peak amplitude of 50 000 ampere and maximum rate of change of current with time of 100 kilo-Amperes/micro-seconds. What would be the approximate peak overvoltage appearing at the output port of the electronic circuit (that is voltage between the inner conductor and the shield of the cable at the base of the tower)?. **Select most reasonable answer** ***1 point***

○ 3000 Volts
○ 300 Volts
○ 10000 Volts
○ 90000 Volts

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*10000 Volts*

4) For a solid shield, it takes some time for the diffusive penetration of currents to the inside of the shield. This is called the diffusive time constant. The diffusion time constant of a copper shield with thickness 0.3 mm and conductivity 5.85x$10^7$ S/m is …….x $10^{-6}$ Seconds. **(Rounded to 2 decimal places)**

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*(Type: Range) 6.5,6.7*

***1 point***

5) Surge protective devices that have an approximately constant voltage across it during the conduction of surge are often described as a 'clamping device.' Which of the following fits this description? ***1 point***

○ A low-pass filter made of passive elements
○ A spark gap in air
○ A metal-oxide varistor
○ A gas discharge tube

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*A metal-oxide varistor*

6) Surge protective devices that change its state from an insulator to a good conductor during the conduction of surge are described as a 'crowbar device.' Which of the following fits this description? ***1 point***

○ A metal-oxide varistor
○ A silicon diode
○ A gas discharge tube
○ An insulation transformer

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*A gas discharge tube*

7) Which of the following statements are true regarding a spark gap ***1 point***
i) Dynamic spark over voltage is greater than static spark over voltage
ii) Dynamic spark over voltage increases with increasing rate of change of applied voltage
iii) The response time (time to breakdown) decreases with increasing rate of change of applied voltage

○ Only i) is true
○ Only ii) is true
○ Only iii) is true
○ all statements i), ii), iii) are true

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*all statements i), ii), iii) are true*

8) Identify the statement most likely to be **false** regarding a gas discharge tube. ***1 point***

○ Gas discharge tubes are 'crow bar devices'
○ Gas discharge tubes have **very low** power handling capacity
○ Gas discharge tubes have **very low** parasitic capacitance
○ Spark over voltage **depends** on the rate of rise of voltage and hence not constant

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Gas discharge tubes have **very low** power handling capacity*

9) Identify the statement most likely to be **false** regarding a metal-oxide varistor. ***1 point***

○ Varistors are '**clamping** devices'
○ Due to its construction, varistors have **large** parasitic capacitance
○ Varistors are highly non-linear devices
○ Varistors are **slow** to respond to a surge

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Varistors are **slow** to respond to a surge*

10) Often a series inductor is provided between primary and secondary protection in installations. Pick the true statements from below regarding this situation ***1 point***

i) To ensure that primary protection acts first during severe surge
ii) Inductor is provided only as an additional series protection and nothing to do with coordination of primary and secondary protection
iii) Inductor helps in protection of secondary protection from destructive surges
iv) To make sure that secondary protection acts first

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

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Only i) and iii) are true*

11) From the statements below, what are applicable for observed electrical characteristics of typical thunderstorms? ***1 point***

i) For lightning, cloud depth must be greater than 3-4 km. Taller thunderclouds produce more frequent lightning
ii) Strong electrification is observed even when cloud does not extends above the freezing level
iii) Strong electrification occurs with clouds having strong convective activity with rapid vertical development
iv) Lightning generally originates in the vicinity of high precipitation regions
v) The location of charge centres are determined by height above ground, not by freezing level

○ All above statements are TRUE
○ Only Statements i), ii), v) are TRUE
○ Only Statements i), iii), iv) are TRUE
○ Only statements ii) and v) are TRUE

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Only Statements i), iii), iv) are TRUE*

12) A streaking image (time-resolved) of a lightning is shown in the picture. What can you tell about the type of lightning in the picture? ***1 point***

○ Downward negative cloud-to-ground lightning
○ Downward positive cloud-to-ground lightning
○ Positive cloud-to-ground lightning, but cannot tell whether it is caused by downward leader or upward leader
○ Negative cloud-to-ground lightning, but cannot tell whether it is caused by downward leader or upward leader

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Downward negative cloud-to-ground lightning*

13) In a cloud-to-ground lightning, what is the typical number of return strokes and the typical time interval between return strokes? **Select the most appropriate** ***1 point***

○ 9 and 5 milliseconds
○ 4 and 50 milliseconds
○ 4 and 50 microseconds
○ 4 and 400 milliseconds

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*4 and 50 milliseconds*

14) Which one of the following statements is false regarding lightning strike to aircrafts? ***1 point***

○ Aircrafts are most likely struck at cruising altitude
○ The intense background electric field from the thunderstorm, causes a bidirectional leader development from the aircraft.
○ During the lightning strike, the potential of the people inside with respect to remote earth will be several million volts
○ The nose and wing tips are most likely entry and exit points for lightning currents

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Aircrafts are most likely struck at cruising altitude*

15) Which type of cloud-to-ground (CG) lightning is most frequent during a summer thunderstorm in the plains of India ***1 point***

○ Upward negative CG lightning
○ Upwards positive CG lightning
○ Downward negative CG lightning
○ Downward positive CG lightning

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Downward negative CG lightning*

16) Which type of cloud-to-ground (CG) lightning is most frequent during a summer thunderstorm to windfarms in the plains of India. Assume that the typical rating of turbines is 500 kW each ***1 point***

○ Downward negative CG lightning
○ Downward positive CG lightning
○ Upward negative CG lightning
○ Upwards positive CG lightning

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Downward negative CG lightning*

17) Pick all the true statements regarding artificial triggering of lightning using the rocket with trailing wire method ***1 point***

i) The method will work only if there is a thunderstorm overhead
ii) Typically, the rocket needs to travel up more than a few km for triggering the lightning
iii) The first return stroke is similar to the first return stroke in natural lightning.
iv) The subsequent leader-return stroke sequence is similar to the subsequent leader-return stroke sequence in natural lightning

○ Only i) and iv) are true
○ All statements are true
○ Only i), ii) and iv) are true
○ Only i) and iii) are true

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Only i) and iv) are true*

18) Pick all the true statements regarding tall tower initiated upward lightning ***1 point***
i) Towers on tall mountains may initiate upward lightning when there are thunderstorms overhead
ii) Tower initiated upward lightning are always of the category upward negative CG lightning
iii) There can be more than one channel between tower and cloud through which lightning currents flow during the same flash
iv) A tall tower can have upward lightning without the classical leader-return stroke sequences of a downward negative CG lightning

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

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*Only i), iii) and iv) are true*

19) Identify a **false** statement from below ***1 point***

○ There are no lightning very far from the land (a few hundreds of km) in the sea
○ In general, lightning within or between clouds are more numerous than lightning between cloud and ground
○ In general, the tropical regions of the earth have several times more lightning than temperate regions
○ It is possible to have lightning like discharges during volcano eruptions

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*There are no lightning very far from the land (a few hundreds of km) in the sea*

20) Which number below represents the average yearly global lightning frequency in average number of lightning per second? ***1 point***

○ 1000
○ 100
○ 1
○ 10

**No, the answer is incorrect.**
**Score: 0**

**Accepted Answers:**
*100*

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