

Name: _____

Questions: Electromagnetics

December 3, 2016

1. Which of the following is NOT required to successfully detect a target
 - (a) The primary field must couple with the target.
 - (b) The primary field must couple with the receiver.
 - (c) The secondary field must couple with the receiver.
 - (d) All of the above are required.

2. The apparent conductivity calculated from an EM 31 survey does NOT depend upon the transmitter
 - (a) Frequency
 - (b) Height
 - (c) Orientation
 - (d) Strength

3. You are collecting EM31 data in an horizontal setting with the boom aligned N-S, and the target is a loop or wire in the ground. The loop has an inclination of 0 and a declination of 90, and is positioned at (0m, 0m, 20m), (easting, northing, depth). Which of the following correctly describes the datum collected at (0m, 0m), with N-S boom orientation?
 - (a) In-Phase is positive, quadrature is positive
 - (b) In-Phase is negative, quadrature is negative
 - (c) In-Phase is positive, quadrature is negative
 - (d) In-Phase is negative, quadrature is positive
 - (e) In-Phase is zero, quadrature is zero

4. Which of the following statements is correct?
 - (a) Frequency band for EM method is higher than GPR.
 - (b) EM31 is a time-domain EM instrument.
 - (c) Faraday's law states that a time-varying magnetic field generates an electric field.
 - (d) Ampere's law is $\vec{J} = \sigma \vec{E}$, where \vec{J} is current density, σ is conductivity, and \vec{E} is electric field.

5. Which of the following is incorrect with regards to EM?
 - (a) We can use the quadrature component to calculate apparent resistivity.
 - (b) We measure in-phase and out-phase components in time-domain EM system.
 - (c) In-phase component is usually used as metal detector.
 - (d) Primary EM field is usually greater than secondary EM field.

6. A time-varying magnetic field
 - (a) Generates an electric field only in conductors.
 - (b) Generates an electric field everywhere.
 - (c) Generates a secondary magnetic field in resistive bodies.
 - (d) Generates currents everywhere.

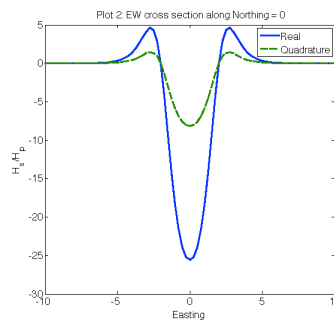
7. Put the processes involved in EM induction in the proper order

generated ($\vec{J} = \sigma \vec{E}$) II. Time-varying transmitter current generates a time-varying magnetic field III. Currents in the conductor generate magnetic fields (secondary) IV. Measure the secondary fields and the primary fields of the transmitter

I. Eddy currents are

 - (a) I-II-IV-III
 - (b) I-II-III-IV
 - (c) II-I-III-IV
 - (d) II-I-IV-III

8. Which of the statements below is FALSE?
- (a) An electric field produces a current according to Ohm's Law.
 - (b) A time-varying magnetic field produces an electric field.
 - (c) The magnetic field measured at the receiver is the secondary field .
 - (d) A time-varying magnetic field generates an electric field everywhere.
 - (e) The primary field decays with distance from the transmitter.
9. Although there is only one source signal, frequency-domain electromagnetic systems normally measure two components of the measurable field. Why is this?
- (a) Because both source and secondary fields are present.
 - (b) Because secondary signals are phase shifted with respect to the source.
 - (c) Two components are required so that diurnal signals can be removed.
 - (d) Two components are needed to separate local from regional anomalies.
10. The figure below shows the response of a frequency domain EM system with horizontal coplanar loops. What does the distance between the two zero crossings represent?



- (a) Width of the buried object.
- (b) Tx-Rx separation distance.
- (c) Height of Tx-Rx above the surface.
- (d) Depth of the buried object.

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11. What produces the zero crossings observed in the above figure?
- (a) No coupling between Tx and target.
 - (b) No coupling between Tx and Rx.
 - (c) No coupling between Rx and target.
 - (d) Both a and c are correct.
12. Suppose that you are trying to locate a treasure chest full of gold that you believe to be buried at a depth of 5m in a 1 ohm-m half-space. Using a frequency-domain EM system, what is the maximum frequency that could be used to identify the chest?
- (a) 200 Hz
 - (b) 1000 Hz
 - (c) 2000 Hz
 - (d) 10000 Hz
13. The secondary magnetic field is
- (a) The magnetic field arising from induced currents in the earth
 - (b) The amplitude of magnetic field measured by the receiver
 - (c) Dependent upon the orientation of the receiver
 - (d) All of the above
14. The “coupling” of a transmitter and a target refers to, or depends upon,
- (a) The ratio of the conductivity of the body to that of the host material
 - (b) The strength of the transmitter current
 - (c) The time that the transmitter current has been turned on
 - (d) The amount of magnetic flux entering the target
15. The apparent conductivities calculated for the following figures were calculated based on the assumption that the earth is a uniform half-space. Identify two regions where you have confidence that the plotted values of the apparent conductivities equal the conductivity of the half-space. It is sufficient to indicate your regions with penciled contours. What is your reasoning for selecting the chosen regions?

