

AMERICAN UNIVERSITY OF BEIRUT  
Geology Department  
Geology 305  
Final Exam



February 3, 1998

Student Name: \_\_\_\_\_

**Part I. Choose the best answer (50 pts.)**

1. The self-potential (SP) method has been used since 1920 in:
  - a. metal exploration
  - b. groundwater investigations
  - c. geological mapping
  - d. geothermal investigations

---

2. The self-potentials range from less than . . . to over . . . volt, and the . . . of the anomaly is an important diagnostic factor.
  - a. 100 mV . . . 10 . . . pattern
  - b. a millivolt (mV) . . . one . . . pattern
  - c. 100 mV . . . 10 . . . sign
  - d. a millivolt (mV) . . . one . . . sign

---

3. Electromechanical potentials belong to . . . potentials.
  - a. mineral
  - b. Nernst
  - c. electrokinetic
  - d. diffusion

---

4. There are two techniques in the measurements of self-potentials. In the potential gradient method, the two electrodes are moved at a . . . separation, whereas in the potential amplitude method, one electrode is kept fixed at a base station on . . . ground and the second one is moved along the traverse.
  - a. fixed . . . unmineralized
  - b. varying . . . unmineralized
  - c. fixed . . . mineralized
  - d. varying . . . mineralized

---

5. The main current application of induced-polarization (IP) method is in . . . exploration.
  - a. ore-bodies
  - b. disseminated metallic-ores
  - c. geothermal
  - d. groundwater

---

6. The exact causes of induced polarization phenomena are . . . the two main mechanisms are . . . polarization and . . . polarization.
  - a. still unclear, but . . . grain (electrolytic) . . . membrane (electrode)
  - b. still unclear, but . . . grain (electrode) . . . membrane (electrolytic)
  - c. well known, and . . . grain (electrolytic) . . . membrane (electrode)
  - d. well known, and . . . grain (electrode) . . . membrane (electrolytic)



7. The most common configuration used in the measurement of IP method is the . . . array.

- a. Wenner      b. Schlumberger      c. pole-dipole      d. dipole-dipole
- 

8. In the . . . IP, the measurements are taken over a wide range of frequencies (0.3 - 4 kHz).

- a. time-domain      b. frequency-domain  
b. phase      d. spectral
- 

9. Due to . . . conductivity, the GPR method has very . . . use in the investigation of landfills.

- a. low . . . limited      b. high . . . limited  
b. low . . . wide      d. high . . . wide
- 

10. The basic difference between Sundberg's and Turam techniques (large-loop systems) is in the:

- a. size of the loop      b. magnitude of the source  
c. number of receiving coils      d. orientation of the coils and the loop
- 

11. In the time-domain electromagnetic systems, the primary field is provided in . . . and the secondary field is measured while the primary field is (switched) . . . .

- a. sinusoidal form . . . on      b. pulses . . . on  
b. sinusoidal form . . . off      d. pulses . . . off
- 

12. In most of the electromagnetic methods, except for GPR, the frequencies of the primary field are usually less than a few . . . hertz, therefore the attenuation associated with the propagation of the primary wave . . . be disregarded.

- a. thousand . . . can      b. tens of . . . can  
b. thousand . . . cannot      d. tens of . . . cannot
- 

13. Several EM methods, such as . . . , exploit the tilt or dip angle of the ellipse of polarization.

- a. VLF and TEM      b. VLF and AFMAG  
b. FEM and TEM      d. FEM and AFMAG
- 

14. The depth of penetration of the EM radiation depends on the:

- a. length of the array      b. frequency of the signal      c. conductivity of the media  
d. all of the above      e. none of the above
-

15. The most commonly used airborne EM systems are deployed from . . . as they can be operated at . . . flying height.
- a. helicopter . . . low                      b. fixed-wing aircraft . . . low  
b. helicopter . . . high                      d. fixed-wing aircraft . . . high
- 
16. The critical factor in seaborne EM surveying is that the sea water is extremely:
- a. resistive                                      b. conductive  
c. dense    d. saline
- 
17. In the tilt angle methods, the conductive ore body is located under the point where the tilt:
- a. is maximal              b. is minimal              c. passes from positive to negative  
d. all of the above              e. none of the above
- 
18. In Turam method, the degree of . . . of the reduced ratio (RR) anomalies increases with . . . dip of the ore body.
- a. asymmetry . . . decreasing              b. fluctuation . . . decreasing  
b. asymmetry . . . increasing              d. fluctuation . . . increasing
- 
19. The static cultural noise, as one of the three sources of error in TEM, is caused by:
- a. topographic effects                      b. AC power lines and VLF transmitters  
c. distant lightning                      d. buried pipes, cables or other metals
- 
20. . . . can be extremely useful in hydrogeological investigations using TEM.
- a. Reduced ratio plots                      b. Vector plots  
b. Apparent resistivity soundings              d. Response contours
- 
21. The main disadvantage of the mageto-telluric method is the:
- a. large depth of investigation              b. long stacking time per site  
c. wide range of frequencies              d. expensive transmission
- 
22. When applied for engineering applications, the antenna frequencies of GPR systems should be more than . . . M. Hz.
- a. 10    b. 50  
c. 100    d. 500
- 
23. . . . is the most effective geophysical tool used in police investigations.
- a. VLF              b. GPR              c. TEM              d. FEM
-

24. The downgoing signal of radiowave propagating in a cone of radiation influences . . . resolution.

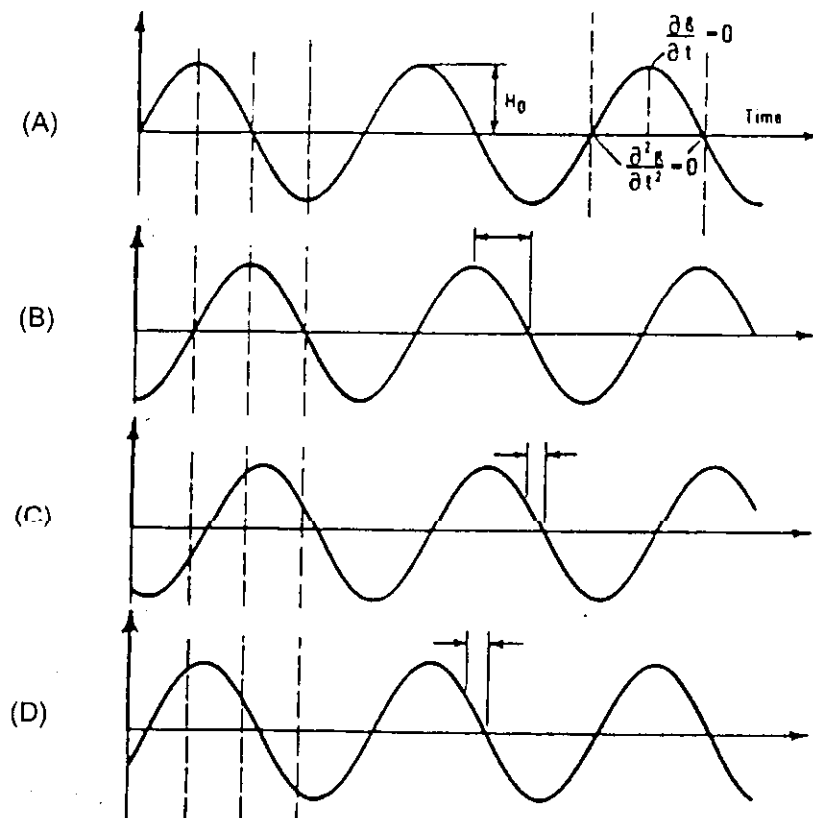
- a. vertical
- b. horizontal
- c. vertical and horizontal
- d. none of them

25. In . . . deployment of GPR, the transmitter and receiver are on opposite sides of the medium under investigation.

- a. transillumination
- b. wide-angle reflection and refraction
- c. common mid-point sounding
- d. radar reflection profiling

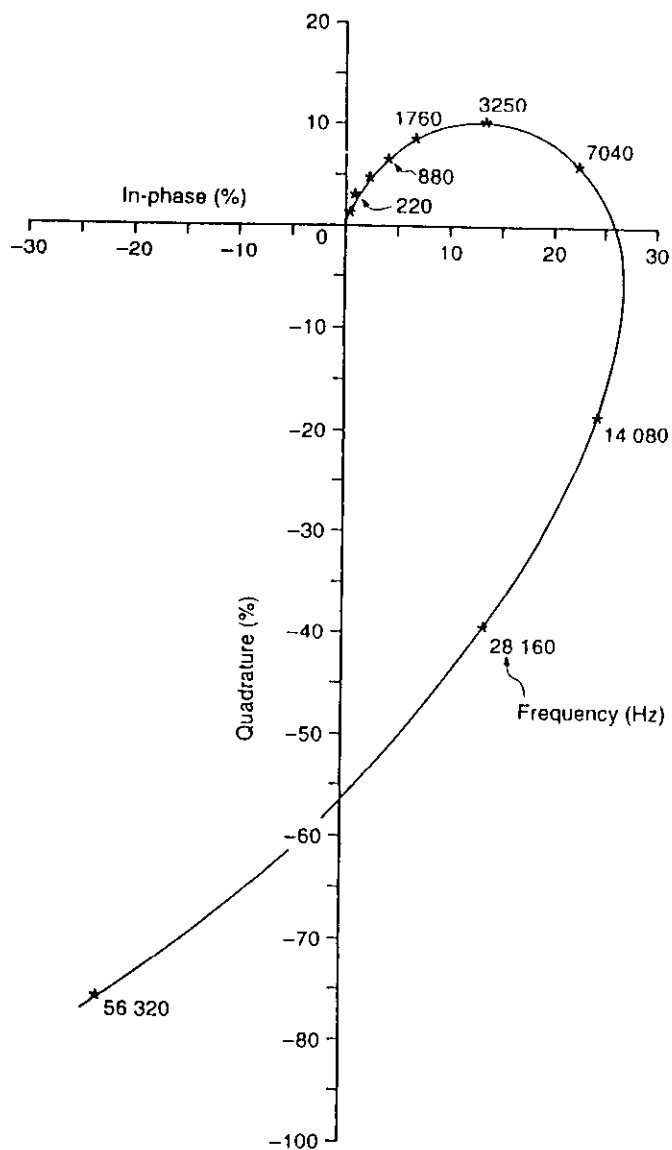
**Part II. Answer only five of the following seven questions (50 pts.)**

1. Discuss the basis for the usage of SP method in two of the following applications: geothermal, location of massive sulphide ore bodies, hydrogeology, landfills, leak detection within embankments; draw diagrams if necessary.
2. Discuss the forms of display of IP data (time-domain and frequency-domain), draw diagrams.
3. Describe the large-loop systems and draw their layouts, draw diagrams.
4. Discuss the principles of operation of the very-low-frequency (VLF) method.
5. Using the shown figure (Fig. 1), explain the relationship between induced voltages and associated phase lags of different magnetic fields.



**Figure 1**

6. The phasor diagram (Fig. 2) is the plot of an EM sounding method. Name and explain this method, and how the diagram is interpreted.



**Figure 2**

7. Name (inside the loops) the basic elements of the given figure (Fig. 3) and define the monostatic and bistatic modes of GPR.

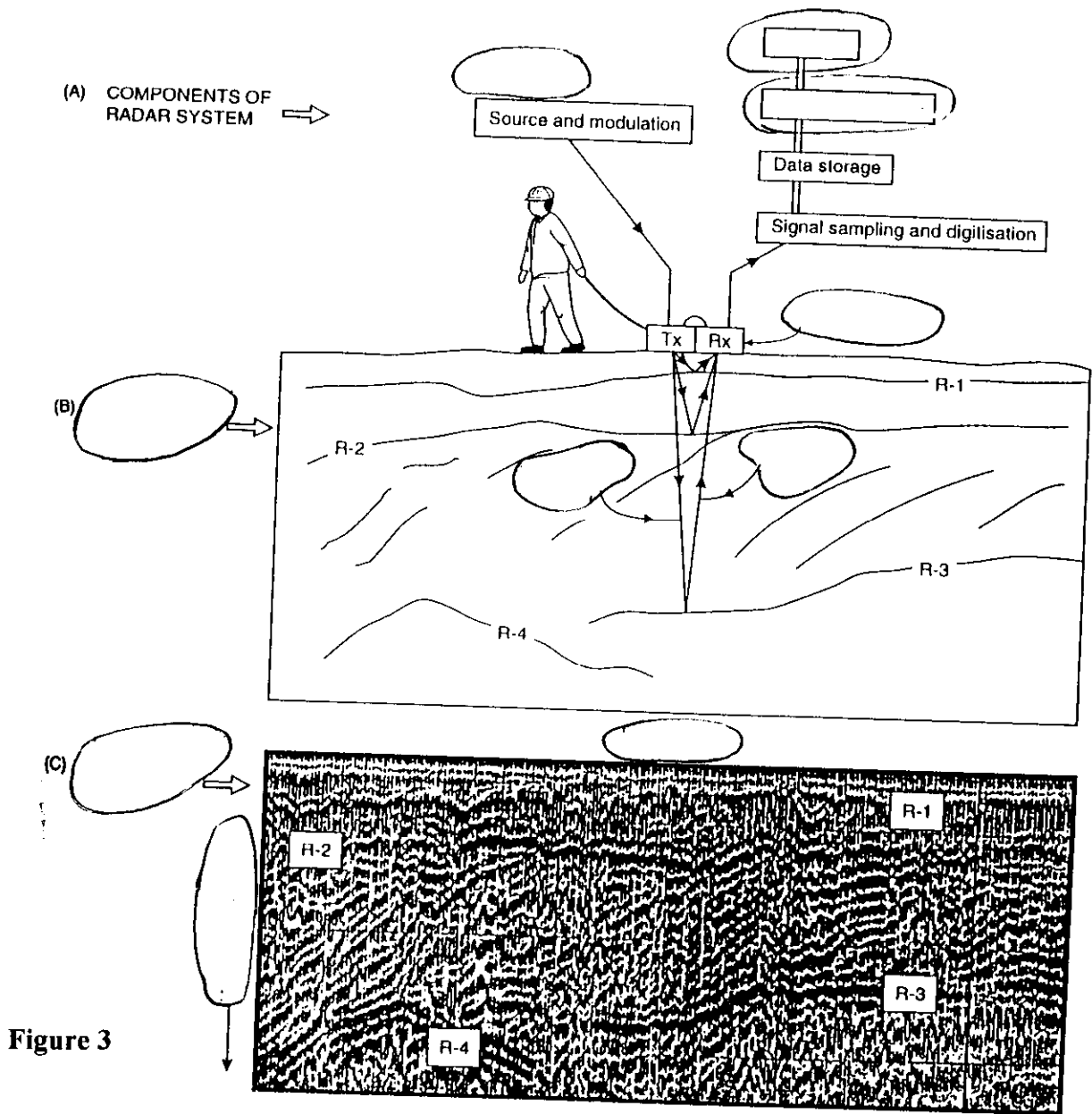


Figure 3

GOOD LUCK