



UNIVERSITY EXAMINATIONS
FOURTH YEAR EXAMINATION FOR THE AWARD OF THE
DEGREE OF BACHELOR OF SCIENCE
SECOND SEMESTER 2022/2023
[JANUARY-APRIL, 2023]

BSMN 425: IMAGING GEOPHYSICS

STREAM: Y4S2

TIME: 2 HOURS

DAY: MONDAY, 3:00 – 5:00 PM

DATE: 03/04/2023

INSTRUCTIONS

- 1. Do not write anything on this question paper.**
- 2. Answer question ONE and any other TWO questions.**

QUESTION ONE: [30 MARKS]

- a) What is geotechnical geophysics as applied in imaging geophysics
[2 Marks]
- b) Surface wave is one of the method used to image subsurface features and engineering structures.
 - i) Why are they called surface waves? [2 Marks]
 - ii) Outline two reasons why Rayleigh wave is important in engineering studies. [4 Marks]
 - iii) Explain why the approximation of Rayleigh wave velocities as shear-wave velocities causes less than 10% error. [2 Marks]
- c)
 - i) Describe the basic concept of spectral analysis of surface waves (SASW) in imaging geophysics [4 Marks]
 - ii) State the mathematical relationship of phase difference spectrum as a function of frequency, defining all terms used. [4 Marks]
 - iii) If the two time functions analyzed are the seismic signals recorded at two geophones a distance d apart, write the expression for velocity as a function of frequency. [2 Marks]
 - iv) State the expression for wavelength λ [2 Marks]
- d) Explain how the following geophysical methods are used to investigate and image engineering structures and their foundations.
 - i) Seismic reflection. [4 Marks]

ii) Cross-hole seismic tomography. [4 Marks]

QUESTION TWO [20 MARKS]

- a) Explain the use of electrical resistivity as a site exploration method for engineering purposes. [2 Marks]
- b) Discuss the procedure used in electrical resistivity method during site exploration for engineering structures. Clearly state the mathematical expressions. [7 Marks]
- c) Explain some applications of resistivity soundings. [5 Marks]
- d) Explain the disadvantages of electrical resistivity method as a geotechnical method. [6 Marks]

QUESTION THREE [20 MARKS]

- a) Explain seismic refraction method as used in site imaging for engineering structures. [4 Marks]
- b) Discuss the procedure employed when carrying out subsurface imaging using seismic refraction method. Clearly state the mathematical expressions. [8 Marks]
- c) Explain the advantages and disadvantages of seismic refraction method when investigating transportation structures and their foundations. [8 Marks]

QUESTION FOUR: [20 MARKS]

- a) Discuss in detail the role of various geophysical methods in solving geotechnical problems. [8 Marks]
- b) In borehole seismic survey, differentiate between down-hole survey and cross-hole survey. [6 Marks]
- c) Explain some applications of Electromagnetic Methods (EM) technique in imaging the Earth's subsurface for construction purposes. [7 Marks]

QUESTION FIVE: [20 MARKS]

- a) Explain the basic concept of the Sonic Echo (SE) as a surface NDT (Non-destructive Tests) method when determining the unknown depths of subsurface bridge system. [4 Marks]
- b) Discuss the data acquisition process in the sonic echo (SE) method during subsurface imaging. [5 Marks]
- c) Discuss the data processing of Sonic Echo (SE) method during subsurface imaging. [5 Marks]
- d) Explain some advantages and disadvantages of sonic echo method. [6 Marks]