BSMN 324: SEISMIC DATA PROCESSING & INTERPRETATION

STREAM: Y3S2 **TIME: 2 HOURS**

INSTRUCTIONS

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

QUESTION ONE (30 MARKS)

a) Why do marine seismic reflection surveys not record (a) S-waves? (b) refracted rays? (4 Marks)

b) How can a primary reflection be distinguished from a multiple one? (2 Marks)

c) At a seismic station, state the first, second and last type of seismic wave to arrive. (3 Marks)

d) What is a seismograph? (2 Marks)

e) On what type of plate boundary would you expect mostly light to minor earthquakes? and on what type of plate boundary would you expect a great earthquake? (2 Marks)

f) Highlight five rules to the seismic velocity ranges of common materials. (5 marks)

g) Explain the curving of seismic waves ray paths. (3 Marks)

h) What is the importance of statics in seismic data processing? (5 Marks)

i) Explain the following terms as used in earthquake seismology.

i. Epicenter (2 Marks)

ii. Focus (2 Marks)

QUESTION TWO (20 MARKS)

a) The P-wave is refracted at the interface between the two layers as shown in Figure 1. Since $V_1 > V_2$ the wave is refracted towards the horizontal. As the angle of incidence is increased, the geometry results in a head wave travelling horizontally in layer 2 as shown in Figure 1. From Snell's Law, we can write

$$\frac{Sin\ \theta_c}{V_1} = \frac{Sin\ 90^\circ}{V_2}$$

Show that total travel time t is given by

$$t = \frac{X}{V_2} + \frac{2Z\sqrt{V_2^2 - V_1^2}}{V_1 V_2}$$ (10 Marks)

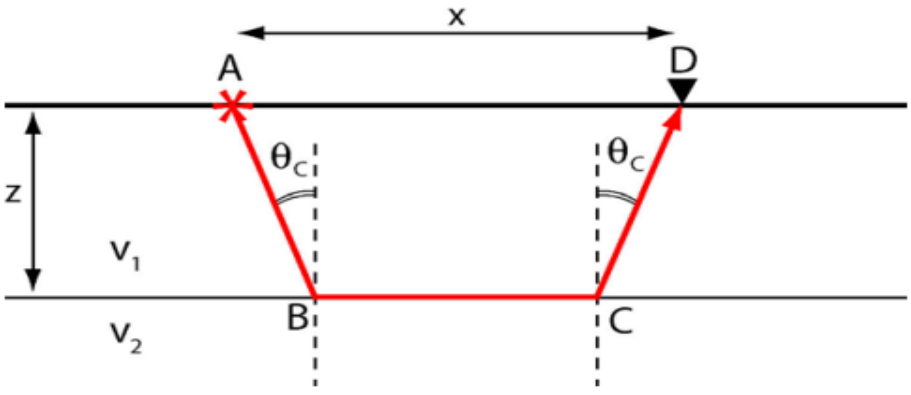

Figure 1

b) Figure 2 shows a travel time curve for the seismic waves. Show that the depth of the interface Z is given by

$$Z = \frac{V_1 V_2 t_i}{2\sqrt{V_2^2 - V_1^2}}$$ Where t_i is the travel time. (10 Marks)

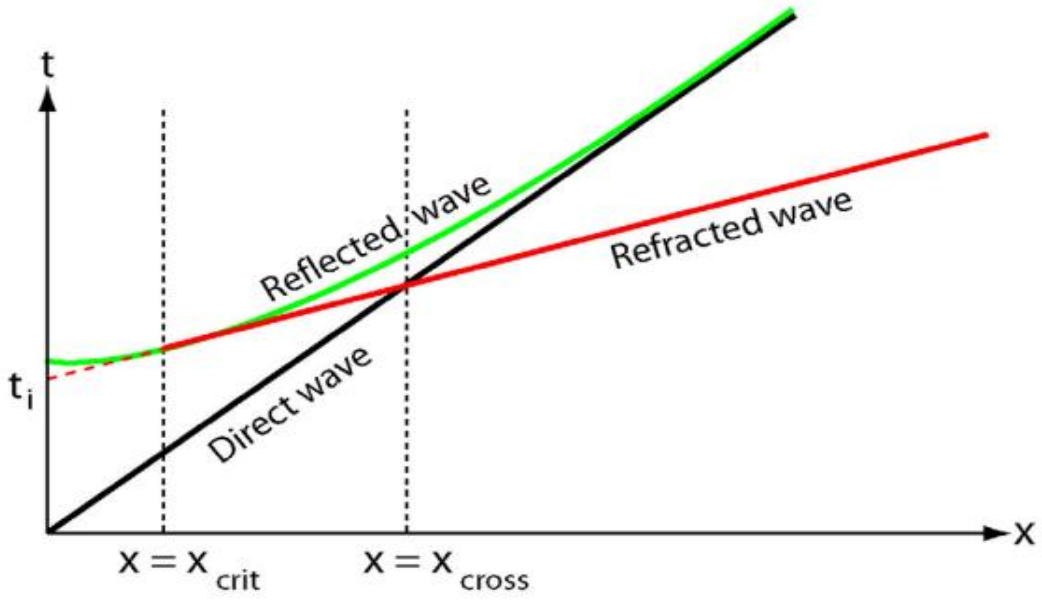

Figure 2

QUESTION THREE (20 MARKS)

a) Travel times differ with offset since the path for a near offset trace is less than the path for a far offset trace. State and explain the correction that can be done to correct the hyperbola reflections. (4 Marks)

b) Describe dynamite as used during land seismic data acquisition. (3 Marks)

c) Outline three factors that time sampling rate depends on during seismic data acquisition. (3 Marks)

d) What is stacking in seismic data processing? Explain the seismic data processing steps that are done before stacking. (10 marks)

QUESTION FOUR (20MARKS)

a) Explain the use of the following in amplitude loss with time or depth during the pre-stack seismic data processing. (9 Marks)

   i. Spherical divergence.

   ii. Transmission loss.

   iii. Absorption.

b) Explain the following as used in elevation correction of seismic data. (4 Marks)

   i. Statics

   ii. Seismic reference datum

c) Seismic sections are not always what they appear. Explain how an apparen t reflector: (7 Marks)

   i. May have an incorrect slope

   ii. May have an incorrect curvature

   iii. May not exist at all

   iv. Three horizontal reflectors spaced equally one above the other may not be equally spaced, in reality?

QUESTION FIVE (20 MARKS)

a) What is a datum plane? Using a diagram, explain three types of datum plane. (8 Marks)

b) What is migration in seismic data processing? How does a migrated reflection seismic section differ from an unmigrated one? In what circumstances would they be the same. (7 Marks)

c) What is sideswipe in seismic data processing. Will a migrated section correct for 'sideswipe'? (5 Marks)