

DEPARTMENT OF PURE AND APPLIED SCIENCES

JANUARY/FEBRUARY 2018 EXAMINATION

COURSE CODE: **PHY361**

COURSE TITLE: **GEOPHYSICS II**

COURSE UNIT: **2 units**

TIME: **2 hours**

INSTRUCTION: Answer any 4 (FOUR Questions) only

QUESTION 1

In a seismogram recorded at a regional distance, the S-P time lag is 5.5 s, and the focus is at a depth $x/2$, where x is the epicentral distance. The model Earth has a single layer of Poisson ratio 0.25 and constant S-wave velocity 1.5 km s^{-1} . Calculate the depth of the focus. And the epicentral distance. (17 ½ Marks)

QUESTION 2

In a seismogram, the S-P time difference is equal to 5.31 s, and corresponds to a regional earthquake that occurred at a depth $h = 2H$, where H is the thickness of the crust. Given that the crust is formed by a layer of constant P-wave velocity of 3 km s^{-1} , that below it there is a semi-infinite mantle of double that speed of propagation, and that Poisson's ratio is 0.25, determine:
(a) An expression for the travel-time of the P- and S-waves. (b) The epicentral distance for an emerging P-wave with a take-off angle of 30° at the focus. (17 ½ Marks)

QUESTION 3

A medium consists of a flat crust of thickness H and constant speed of propagation v_1 on a semi-infinite mantle of constant speed of propagation v_2 . For a focus at the surface, at a distance x the direct wave arrives at a time $t_1 = x/a$, the critical distance is $x_c = 2a/\sqrt{3}$, and the direct and critical refracted waves intersect at the distance $x = 2a\sqrt{3}$, calculate the crust's thickness, its speed of propagation, the mantle's speed of propagation, and the critical angle. (17 ½ Marks)

QUESTION 4

A medium consists of a flat crust of thickness H and constant speed of propagation v_1 on a semi-infinite mantle of constant speed of propagation v_2 that dips downwards at 45° . For a focus at the surface, at a distance x the direct wave arrives at a time $t_1 = x/a$, the critical distance is $x_c = 2a/\sqrt{3}$, and the direct and critical refracted waves intersect at the distance $x = 2a\sqrt{3}$ calculate the travel times of the reflected and critical refracted waves at $x = a$, $3a$, and $5a$. (17 ½ Marks)

QUESTION 5

Consider a semi-infinite medium in which the velocity increases linearly with depth according to the expression $v = 4 + 0.1z$. There is a seismic focus at a depth of 10 km. Calculate the epicentral distance reached by a wave leaving the focus at an angle of 30° . (17 ½ Marks)