Branch: IS (Makro)
Course: Physics
Teaching form: Classes
Semester: 2
Academic Year: 2018/2019

PRACTICE PROBLEMS - SET 4
MECHANICAL WAVES AND SOUND WAVES

Problem #1.
The equation of a transverse traveling wave on a string is $y(x,t) = 2\sin(200\pi \cdot t - 0.5\pi \cdot x)$ in cm; where time t is in s and x in m. Determine the amplitude *A*, wavelength λ, period *T*, frequency *f*, velocity υ and the direction of wave motion.

Problem #2.
Wave at the surface of lake strickes (hits) on the bank $n = 15$ times per minute. A distance between the backs of wave is $d = 5\ m$. Determine the velocity of wave υ running at the surface of lake.

Problem #3.
Mechanical waves is travelling with a velocity $\upsilon = 30\ m/s$. Determine its wavelength λ and frequency *f* when the period of travelling $T = 10\ s.$ For comparison with sound wave travelling in air with velocity $\upsilon = 340\ m/s$ determine its wavelength λ for the boundary values of frequencies *f* in the range of *16 Hz* and *20 kHz,* respectively.

Problem #4.
Taking into account that the velocity of travelling of sound wave in air $\upsilon = 340\ m/s$ determine the distance at which the echo of sound returns from a vertical wall after time t = 0,7 s after its generation.

Problem #5.
An organ pipe which acts as a open-end resonator has a length $L = 83\ cm$. Its fundamental frequency $f = 210\ Hz$. Determine the speed of sound waves in the air column of pipe, as well as the frequency f_n of second, third and fourth harmonics of the organ pipe.

Problem #6.
A SONAR system is used to detect the ocean's bottom. Sound waves are emitted from SONAR system at the surface of ocean and travel through the water at velocity υ = 1450 m/s. The ocean bottom is at depth $d = 1630\ m$ below the surface. Determine a time that passes before the sound waves are reflected back to the ocean surface.

Problem #7.
A sound impression level from the source heard by the received recipient $\beta = 80\ dB$. Determine the corresponding absolute (physical) sound intensity I.

Problem #8.
Determine the sound impression level of the following sound sources ta king into account their estimated physical sound intensities: in science office at early morning $I = \sim 10^{-9}\ W/m^2$, in a student's library after school: $I = \sim 10^{-6}\ W/m^2$ and in a classroom during a break before starting a lesson $I = \sim 10^{-4}\ W/m^2$.

Problem #9.
A fire truck emits a siren with sound of frequency $f_t = 880\ Hz$. As the truck approaches an observer on the sidewalk, he perceives the pitch having the frequency $f_o = 950\ Hz$. Determine the pitch being heard after the truck passes and is moving away? Assume that the truck's velocity remains constant, and that the velocity of sound in air $\upsilon = 340m/s$.

in some problems some additional assumption based on the general knowledge may be necessary