Indian Institute of Technology, Kharagpur

Centre for Educational Technology

**MID Semester Examination 2018 (Spring)**

**Subject: Audio System Engineering Code: ET60006**

Time: 2:00 Hours Full Marks [5x2+4x10] = 50

***Answer all the questions***

***PART-A***

1. An earth quake wave was traveling through the earth and the intensity detected **200 Km** from source was **8.0x 106 W/m2**. What is the intensity [**in dB**] of the earth quake wave at a distance **600 km** from the source?
2. The human leg has a measured natural frequency of around **20 Hz** when in its rigid (knee locked) position, in the longitudinal direction (i.e., along the length of the bone) assuming no damping. What will be the maximum displacement of the leg? At ***t=0*** the initial speed ***u0=0.06 m/s*** and displacement ***x0=0***.
3. Suppose an electric fan produces sound of intensity ***30 dB***. How many times more intense is the sound of a conversation if it produces an intensity of ***60 dB***?
4. An acoustic signal is reflected from a surface and **80%** is absorbs. The reflected signal will drop by how many **dB**.
5. In case of sound perception why we need two ear?

***PART-B***

1. A mechanical oscillator with mass ***0.5kg***, stiffness ***100N/m*** and mechanical resistance ***1.4kg/s*** is driven by a sinusoidal force of amplitude ***2N***.
2. Find out the driving force frequency for which phase angle between displacement and speed is **π/3**.
3. Find out the maximum displacement at that phase angle.
4. a) Given a small source of spherical wave in air at a radial distance of ***100 cm***, compute the absolute magnitude of the specific acoustic impedance for ***500Hz*** frequency at this location. Then density of air ***ρ0=1.21 kg/m3*** and velocity of sound in air ***c = 340m/s****.*
5. Show that the specific acoustic reactance of a spherical wave is maximum for ***kr=1***. Where *r* is the radial distance and *k* is the propagation constant.
6. A pressure wave is obliquely incident on the boundary of two fluids (1 and 2). The speed of the wave in fluid 1 and 2 are c1 and c2 respectively. If c1<c2 and θi> θc show that the transmitted wave propagate in y direction, parallel to the boundary and has an amplitude that decays perpendicular to the boundary. Where θi is the angle of incident and θc is the critical angle. The above wave propagation is in x-y plane.
7. A plane wave traveling from air into Xenon gas through a thin separating membrane is refracted by ***450*** from its original direction.
8. Calculate the angle of incident in the air
9. Determine the sound pressure transmission coefficient in ***dB***.

(Where velocity of sound in air ***c1= 350 m/s*** and density of air ***ρ1=*** ***1.225 x10−3 g/cm3*** velocity of sound in Xenon ***c2=173 m/s***, and density 178 ***ρ2= 5.761 kg/m3)***