Indian Institute of Technology, Kharagpur

Centre for Educational Technology

**MID Semester Examination 2016 (Spring)**

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

Time: 2:00 Hours Full Marks [10+4x10] = 50

***Answer all the questions***

***PART-A***

1. A ***100 Watt*** amplifier has gain of ***64 dB***. What input level in **dBm** will drive the amplifier in full power?
2. An acoustic signal is reflected off of a surface that is ***80%*** absorptive. The reflected sound will be drop by how much **dB**.
3. An earth quake wave was traveling through the earth and the intensity detected ***100 km*** from source was ***5.0x 106 W/m2***. What is the intensity of the earth quake wave at a distance ***200 km*** from the source?
4. Two liquids are separated using a very thin solid membrane. If a sound source is producing a sound in the 1st liquid what will be the effect of the solid membrane in case of transmission of sound from one liquid to other.
5. A loudspeaker produce sound pressure level ***99 dB*** at ***4 ft*** from the loudspeaker with 1 watt. How many watts are needed to produce sound pressure level ***115 dB*** at the same distance?

***PART-B***

1. A mass of ***0.5 kg*** hangs on a spring. The stiffness of the spring is ***100 N/m*** and the mechanical resistance is ***1.4 kg/s.*** The force driving the system is ***f=2 cos 5t***.
2. Calculate the maximum steady-state displacement, average power dissipation, phase angle between speed and force and the resonance frequency [5]
3. What is the ***Q*** value of the system and over what range of frequencies will the power loss be at least ***50%*** of its resonance value. [5]
4. An air-conditioning chiller unit weighing ***2,000 kg*** is supported by four air springs with stiffness of ***1000 N/m*** and mechanical resistance is ***2.5kg/s***.
5. Draw the equivalent electrical circuit of the above mechanical system and find the mechanical impedance with its corresponding unit. [3+4]
6. Calculate the resonance frequency of the above system. [3]
7. A ***1 kHz*** small source of spherical waves in air has produce sound pressure amplitude of ***100 dB*** ***(Pref = 20μPa)***, at a radial distance ***1 m*** from the source.
8. Find the absolute magnitude of the specific acoustic impedance. Where density of air ***ρ0=1.21kg/m3*** and speed of sound in air ***c=343m/s***. [5]
9. Plot the absolute magnitude of the specific acoustic impedance as a function of radial distance for various frequencies. [5]
10. Plane wave in water of ***100 Pa*** effective (rms) pressure are incident normally on a sand bottom. The sand bottom is characterized by ***ρ2=2000kg/m3***and ***c2=1600m/s***. where speed of sound in water ***c1= 1450 m/s*** and density ***ρ1=1000kg/ m3***

(a) Calculate the effective pressure of the wave reflected back into water and the effective pressure of the wave transmitted into sand [4+4]

(b) What is the smallest angle of incidence at which all the incident energy will be reflected back. [2]