Indian Institute of Technology, Kharagpur

Centre for Educational Technology

**MID Semester Examination 2017 (Spring)**

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

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

***Answer all the questions***

***PART-A***

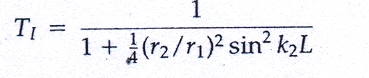
1. A critically damped shock absorber is to be design for a motorcycle of mass ***300 kg***. When the shock absorber is subjected to an initial vertical velocity due to a road bump, the resulting relaxation time is found ***3 sec***. Find the necessary stiffness of the shock absorber.
2. If the input voltage of a loud speaker is raised by ***30%*** how many dB will be increase the acoustic pressure
3. The equation of a plane wave given in equation no.-1. In what direction does this wave travel?



1. In an outdoor acoustic the ambient noise level is **70dB** and a sound system generate SPL of ***110 dB*** at ***4ft***. How far the sound will travel before it submerged with noise.
2. What is equal loudness curve or phone curve? Draw an equal loudness curve for ***10 dB***.

***PART-B***

1. 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***. During the operation of the air-conditioning chiller unit it vibrate with the driving force ***f=4 cos 6t***.
2. Calculate the **maximum** **steady-state displacement** and **phase angle** between speed and force
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.
4. A spherical waves in air has a produce sound pressure amplitude of ***100 dB*** ***(Pref = 20μPa)***, at a radial distance ***r=1 m*** from the source.
5. Plot the ratio of amplitude of the pressure ***P*** and the particle speed ***U*** as a function of various frequencies at that distance. Where density of air ***ρ0=1.21kg/m3*** and speed of sound in air ***c = 343m/s***.
6. Determine the radial distance where the spherical waves approximate the behavior of plan wave within about ***10%***.
7. For ***2 kHz*** plane sound wave in water incident normally on a steel plate of ***1.5 cm*** thickness.
8. Calculate the **transmission loss expressed in dB**, through the steel plate into water on the opposite side. The expression for intensity transmission coefficients is as below where ***r1*** and ***r2*** are the characteristic acoustic impedance of water and steel respectively (where velocity of sound in water ***c1= 1450 m/s*** and density of water ***ρ1=1g/ cm3*** velocity of sound in steel ***c2=5800 m/s***, ***ρ2=7.8g/cm3)***



1. Determine the frequency of the source for which steel plate does not interfere for sound transmission
2. (a) Draw the equivalent electrical circuit for the following mechanical system and find the mechanical impedance with its corresponding unit, where ***Rm=1.4 kg/s****,* ***s1=30 N/m***, ***m=70 kg*** and ***F=2cos 314t***

Rm

S1

m

F

(b) 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 ***400 km*** from the source?