

IE-341

Section 1, CRN: 30512

Section 2, CRN: 30515

First Semester 1432-33 H (Fall-2011) – 3(2,1,2)

HUMAN FACTORS ENGINEERING

Wednesday, Nov 23, 2011 (27/11/1432H)

Quiz 4 **ANSWERS**

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**Answer ALL of the following questions [2 points each]**

1. What are the two main attributes of sound?

**Frequency, Intensity**

2. What is the frequency of a sound wave (cycle) that is completed in 0.1 sec? (show how obtained your answer)

$$\text{Frequency} = \frac{\text{number of cycles}}{\text{time}} = \frac{1 \text{ cycle}}{0.1 \text{ sec}} = \mathbf{10 \text{ Hz}}$$

3. Calculate the SNR for a 110 dB noise and 10 B signal? What is the meaning of this answer?

$$\text{SNR} = \text{Signal} - \text{Noise} = 100 \text{ dB} - 110 \text{ dB} = \mathbf{-10 \text{ dB}}$$

A negative SNR indicates that noise is louder than the signal, and thus all that will be heard will be noise (i.e. the signal will not be audible/detectable).

4. An experiment is conducted on 80 volunteers to test their sensitivity to change in sound intensity. Describe how you can measure the JND for the subjects.

JND (Just Noticeable Difference) is measure of the discriminability (detecting the difference) of an aspect of sound (in this case intensity). Thus, the JND can be measured as the change (increase or decrease) of volume that can just be sensed by 40 (i.e. 50%) of the subjects.

5. Define stereophony. What factor is used to determine stereophony for sounds having low frequency (i.e.  $< 1500 \text{ Hz}$ )?

Localization/stereophony is the ability to guess or predict the direction from which the sound is coming.

For frequencies less than 1500 Hz, this is achieved by detecting the **lag** (phase) in sound reaching one ear before the other.