UNIVERSITY OF SWAZILAND
FACULTY OF HEALTH SCIENCES
BSc IN ENVIRONMENTAL HEALTH SCIENCE
(FINAL EXAMINATION)

TITLE OF PAPER   : ACOUSTICS AND HEALTH II

COURSE CODE   : EHS 570

TIME   : 3HOURS

TOTAL MARKS   : 100

INSTRUCTIONS:

- QUESTION 1 IS COMPULSORY

- ANSWER ANY OTHER THREE QUESTIONS

- ALL QUESTIONS ARE WORTH 25 MARKS EACH

- FORMULAE AND OTHER DATA IS PROVIDED

- NO FORM OF PAPER SHOULD BE BROUGHT IN OR OUT OF THE EXAMINATION ROOM

- BEGIN THE ANSWER TO EACH QUESTION IN A SEPARATE SHEET OF PAPER.

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QUESTION 1

I.

Multiple choice: Write True or False against each letter corresponding to the following statements as they apply to acoustics.

(a) When a noise source is located in any environment, other than free field, the sound pressure level at any point will depend on the sound power level, the directivity factor and the sound energy reflected back into the field by the surrounding walls of the environment.

(b) The Noise Reduction coefficient is the arithmetic average of absorption coefficients in the four octave bands 125 Hz and 2000 Hz

(c) The room constant, R, is a measure of the absorption / reflection characteristic of the room or enclosure.

(d) The risk of hearing loss from high noise environments depends on both the level of noise and the length of time an individual is exposed to that level.

(e) In the regions closer to the noise source, the direct field dominates and the sound power level is independent of the room constant, R, and therefore the sound can be reduced by adding sound absorption to the enclosure.

(f) Where the noise level fluctuates, as it happens in most industrial situations, the concept of the equivalent continuous sound level is used.

(g) The C-weighted response stimulates the sensitivity of the human ear at high sound levels.

(h) The reverberation time is the time taken for the intensity of a sound to be reduced to tone billionth of the level existing when the source was switched off.

(i) The acceptability of noise should be judged by whether the level of the noise and exposure to the noise can cause hearing loss, annoy people or interfere with speech communication, hearing or emergency warning signals.

(j) A noise survey takes noise measurements throughout an entire plant or section to identify noisy areas.

(k) Frequency analysis is not required when the purpose of noise measurement is to assess compliance with regulatory exposure limits or to assess risk of hearing loss.

(22 marks)

II.

Briefly describe noise regulation as applied in acoustics and health.

(3 marks)

QUESTION 2

I.   Describe the following noise control measurements as applied in Acoustics and health.

a) Administrative controls

(3 marks)

b) Engineering controls

(8 marks)

II.

Describe measurement of workplace noise

(14 marks)

QUESTION 3

a) The best first step to reduce noise is to develop a written noise control plan. Describe the components of such a plan.

(6 marks)

b) A 5 m x 10 m x 3m room has a 1 microwatt ($1 \mu W = 10^{-6}$ watts) sound source located in the centre of the 5 m wall where the floor and the wall meet. The absorption coefficients associated with the room are: walls $\alpha = 0.02$, floor $\alpha = 0.1$ and ceiling $\alpha = 0.26$.
Find the sound pressure level at the centre of the room first taking into account the presence of the reverberant field and then assuming only direct sound radiation from the sound source.

(11 marks)

c) Describe a noise survey

(8 marks)

QUESTION 4

Describe the five (5) primary reasons for reducing noise levels in an occupational environment.

(25 marks)

QUESTION 5

a)

A 2.4m x 6m, 10.2cm thick brick wall has one 0.3175cm thick 0.9m x 1.5m windows in it.

> **NB**: The specific surface density for the brick is 21kg/m^2/cm and for glass are 24.7 kg/m^2/cm.

i) Compute the normal incidence transmission loss for the brick wall and windows individually and at a frequency of 500Hz.

(7 marks)

ii) Compute the normal incidence transmission loss of the composite barrier composed of the brick wall and two windows.

(4 marks)

b) An office is separated by a partition wall of area 100 m^2 having a sound reduction index of 40 dB. A door of area 2.5 m^2 having a sound reduction index of 30 dB is added to the partition. If the room adjoining the office has sound pressure level of 75 dB, find the sound pressure level in the office when the door is closed and when it is open.

(7 marks)

c) A worker in an engineering workshop is exposed to the following noise levels:
87 dBA for 3hours
90 dBA for 2hours
95 dBA for 1.5hours
Determine L$_{EP,d}$ for this individual.

(7 marks)