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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : ACOUSTIC & NOISE CONTROL
COURSE CODE : BDC 40803
PROGRAMME CODE : BDD
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

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- Q1** (a) Choose either A or B which suit the correct answer.
- i. SPL means the level, in decibels, calculated as _____ times the common logarithm of the ratio of a sound pressure to the sound pressure of 20 micropascals.
 - A. ten
 - B. twenty.
 - ii. Noise mapping is use to identify _____.
 - A. noisy machinery, process and areas
 - B. sound emitted by noise sources.
 - iii. Based on degree of fluctuation, noise can be classified as _____.
 - A. continuous or intermittent
 - B. steady, fluctuating and impulsive
 - iv. The estimate of employees' exposure should be representative of the work that they do, taking into account:
 - I. the work they do or are likely to do
 - II. the ways in which they do the work
 - III. how it might vary from one day to the next
 - A. I & II
 - B. I, II & III
 - v. The noise exposure limit (NEL) as stipulated under the Occupational Safety & Health (Noise Exposure) Regulations 2019;
 - I. Daily noise exposure limit exceeding 82 dB(A)
 - II. Daily personal noise dose exceeding 100%
 - III. Peak SPL exceeding 140 dB(C)
 - A. II & III
 - B. I, II & III

(5 marks)

- (b) Write four (4) objectives of noise risk assessment that conducted by a noise risk assessor (NRA) who is registered with the Director General.

(4 marks)

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- (c) Distinguish between noise zoning and noise contouring with an example a sketch of work area with two (2) machineries layout which generate noise 90 dB(A) and 88 dB(A), respectively.

(5 marks)

- (d) Evaluate the procedure to measure employees' exposure monitoring using noise dosimeter as a requirement in personal exposure monitoring.

(6 marks)

Q2 (a) Choose the correct answer for the items below either A or B:

- i. Employers purchasing new plant shall obtain noise level information from _____.
- A. Manufacturer or Supplier
 - B. Designer or Contractor
- ii. Principle of noise engineering control based on NIOSH standard are:
- I. Absorption
 - II. Acoustic
 - III. Damping
- A. I & III
 - B. I, II & III
- iii. Dissipative type of silencer or muffler can be define as _____.
- A. Governed primarily by its internal configuration and reduction of flow velocity by abrupt changes in shape and resonance of added branches or cavities to a pipe or duct.
 - B. Governed primarily by the presence of sound absorbing material that dissipates acoustic energy.
- iv. Daily exposure duration limit for employee expose to noise level of 91 dB(A) is _____
- A. 2 hours
 - B. 2 hours 31 minutes

- v. Areas where persons may be permanently exposed to noise levels exceeding the noise exposure limit (NEL) shall be sign-posted as _____.

A. NOISY AREA

B. HEARING PROTECTION ZONES

(5 marks)

- (b) You has been appointed by top management as hearing conservation administrator to manage noise exposure at workplace. Employ four (4) noise control procedures that recommended method of approach according to the order outlined from NIOSH & DOSH, Malaysia.

(4 marks)

- (c) Solve the following questions by using noise control formula:

- i. Noise level is 90 dB (SPL₁) at 1 meter (r₁). Calculate noise level (SPL₂) at distance of 2 meter (r₂)?
- ii. A worker exposed to daily noise exposure level, L_{EX,8H} = 93 dB(A) and given an ear plug with the NRR = 29 dB(A). Calculate the NRR_{ACTUAL} and the new estimated noise exposure after wearing the PHP?

(5 marks)

- (d) A chiller pump motor had been use for transmit the cold chill water as a part of Heating, Ventilation & Air Conditioning (HVAC) system which produce up to 93 dB(A) noise level. As a mechanical engineer, you are required to propose noise engineering control measure at the sound source generation. Support your recommendation with a rule of thumb noise engineering control procedure.

(6 marks)

- Q3 (a) Each acoustic field coefficient have their own mathematical equation. Identify the correct match for the items in the two columns below:

1. Sound absorption coefficient, α	a. $\frac{(\alpha_{200} + \alpha_{500} + \alpha_{1000} + \alpha_{2000})}{4}$
2. Reverberation time, T	b. $10 \log\left(\frac{1}{t}\right) \text{ dB}$

3. Noise reduction coefficient, NRC	c. $\frac{(E_i - E_r)}{E_i}$
4. Room constant, R_c	d. $\frac{S\alpha_{mean}}{(1 - \alpha_{mean})}$
5. Sound reduction index, R	e. $\frac{0.16V}{A}$

(5 marks)

- (b) The absorption technique was among the effective noise control measures despite insulation technique. Illustrate and explain the type of absorbers with absorption coefficient against frequency diagram.

(4 marks)

- (c) A workshop of dimensions 8 m long x 6 m wide x 4 m high with hard sound reflecting surfaces is to be refurbished as a room for meetings. The reverberation time is measured and found to be 3.0 seconds in a particular octave band.

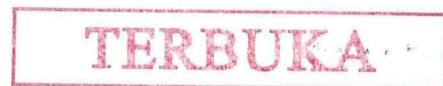
- i. Value how much extra sound absorption must be introduced into the room in order to reduce the reverberation time to 0.8 seconds, suitable for speech.
- ii. If this is to be achieved using carpet on the floor with an α value of 0.2 in the same band and by covering areas of the wall and ceiling with sound absorbing panels having sound absorption coefficient, α value of 0.4. Decide the area of these panels which must be used. (Use Sabine's formula)

(5 marks)

- (d) A partition between two rooms with dimension of 6 m x 3 m and consist of a door with dimension 2 m x 1 m and two windows, each have dimension of 1.5 m x 1 m. In a certain octave band the wall has room constant, R value of 45 dB, the door of 35 dB and the window of 20 dB.

- i. Judge the effective or average room constant, R value of the partition.
- ii. Value the above statement in (d) but allowing for a 2 mm air gap around the door.

(6 marks)



- Q4** (a) Determine the following statement whether true or false.
- (i) Enclosure are sound insulating structures for the total containment or exclusion of a sound field. [True / False]
 - (ii) TL define Transfer Loss of enclosure. [True / False]
 - (iii) Barriers or screens placed in the path of free field sound source radiation will create a relatively quieter zone in the acoustic shadow. [True / False]
 - (iv) Primarily affects the direct sound and also on reverberant sound due the surface reflection of the barrier wall. [True / False]
 - (v) Claddings are sound insulation layers applied on the external surfaces of pipes and ducts. [True / False]

(5 marks)

- (b) The use of an enclosure made of a good sound insulating material to reduce the noise from a machine is an obvious and attractive solution to a noise problem. Interpret the four (4) acoustic enclosures principles.

(4 marks)

- (c) The effective of a barrier in reducing sound transmission between source and receiver is limited by diffraction of sound over the top and around the sides of the barrier, which is determined by the size of the barrier compared with wavelength of the sound. However, there is some limitations to the performance of barrier. Support the limitation statement with justification.

(6 marks)

- (d) Damping can be important in reducing the level of vibration and therefore of radiated noise from thin sheet panels.

- i. Defend these statement by explaining two (2) cases for which the amount of damping of panel material will effect the level of vibration and noise.
- ii. Evaluate three (3) possibilities of damping of thin sheet panel increments.

(5 marks)

- Q5** (a) Determine the following statement is true or false.
- (i) Noise control is not a safety issue. [True / False]
 - (ii) Effective noise control must be based on an accurate diagnosis and on assumption. [True / False]
 - (iii) Unless the dominant source is treated first, the overall noise reduction will be very disappointing. [True / False]
 - (iv) Noise generation categorization consist of two major components that are aerodynamic and mechatronic. [True / False]
 - (v) Enclosure define as building a box around noise sources such as lagging. [True / False]
- (5 marks)
- (b) Classify four (4) fundamental of noise controls best practice techniques in order to attenuate the noise level.
- (4 marks)
- (c) Demonstrate the source ranking techniques use as noise control diagnosis procedure.
- (6 marks)
- (d) As a noise risk assessor (NRA), you are required to perform noise audit checklist using semi quantitative noise risk assessment form. Support your assessment by fill up the form with an example of cutting activities group exposure.
- (5 marks)

-END OF QUESTION-

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USEFUL FORMULAS:Transmission coefficient, t :

$$t = 10^{-\frac{R}{10}}$$

Transmission coefficient average, t_{avg} :

$$t_{avg} = (t_1 S_1 + t_2 S_2 + \dots + t_N S_N) / S_{Total}$$

Average sound reduction index, R_{avg} :

$$R_{avg} = 10 \log \left(\frac{1}{t_{avg}} \right)$$

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