Second Semester Examination
2017/2018 Academic Session

May/June 2018

EAP318 – Noise Pollution Control
(Kawalan Pencemaran Bunyi)

Duration : 2 hours
(Masa : 2 jam)

Please check that this examination paper consists of **EIGHT (8)** pages of printed material including appendix before you begin the examination.

[*Sila pastikan bahawa kertas peperiksaan ini mengandungi **LAPAN (8)** muka surat yang bercetak termasuk lampiran sebelum anda memulakan peperiksaan ini.*]

Instructions : This paper contains **FIVE (5)** questions. Answer **FOUR (4)** questions.

[***Arahan** : Kertas ini mengandungi **LIMA (5)** soalan. Jawab **EMPAT (4)** soalan.*]

In the event of any discrepancies, the English version shall be used.

[*Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.*]

1. (a). With an appropriate example and a sketch diagram, describe **TWO (2)** of the main mediums of noise propagation.

*Dengan contoh yang sesuai dan lakaran kasar, terangkan **DUA (2)** daripada medium utama penyerakan bunyi.*

[6 marks/*markah*]

(b). With the help of a sketch wave diagram, indicate and define amplitude, period, wavelength, speed, and frequency. State their relationships.

Dengan bantuan lakaran rajah gelombang, tunjuk dan definisikan amplitud, tempoh, jarak gelombang, kelajuan dan frequensi. Nyatakan hubung kait antaranya.

[7 marks/*markah*]

(c). Calculate the frequency in MHz of a sound with wavelength of 0.3 m that travels at a speed of $3x10^6$ m/s.

Kirakan frequensi dalam MHz untuk suatu sumber bunyi dengan jarak gelombang 0.3 m dan bergerak pada kelajuan $3x10^6$ m/s.

[6 marks/*markah*]

(d). Prove that Sound Pressure Level, L_p can be written as $L_p=20 \log_{10} (P/P_o)$, where P_o is the reference pressure.

Buktikan bahawa Paras Tekanan Bunyi, Lp boleh ditulis sebagai $L_p=20 \log_{10} (P/P_o)$, di mana P_o adalah tekanan rujukan.

[6 marks/*markah*]

2. (a). There are many types of noise analyses. Define 'octave band' and state **TWO (2)** of its applications in civil engineering.

*Terdapat beberapa jenis analisis bunyi. Definisikan 'jalur oktaf' dan nyatakan **DUA (2)** aplikasinya dalam kejuruteraan awam.*

[7 marks/*markah*]

(b). The following ideal noise levels in dB (A) were generated at the same time in a control room: 55, 65, 73, 80, 77. Calculate the composite Sound Power Level (Lw) that will be heard. Comment your answer.

Paras bunyi ideal berikut dalam dB (A) dijana serentak dalam bilik kawalan: 55, 65, 73, 80, 77. Kirakan Paras Kuasa Bunyi (Lw) komposit yang bakal didengari. Komen jawapan anda.

[10 marks/*markah*]

(c). Using the Equivalent Noise Level Contour given in **Figure 1**, differentiate the noise level at the referenced frequency for two noise sources 100 dB @ 60 Hz and 80 dB @ 33 Hz. Comment your answer.

*Menggunakan Kontur Paras Bunyi Setara dalam **Rajah 1**, bezakan paras bunyi pada frekuensi rujukan untuk dua sumber bunyi 100 dB @ 60 Hz dan 80 dB @ 33 Hz. Komen jawapan anda.*

[8 marks/*markah*]

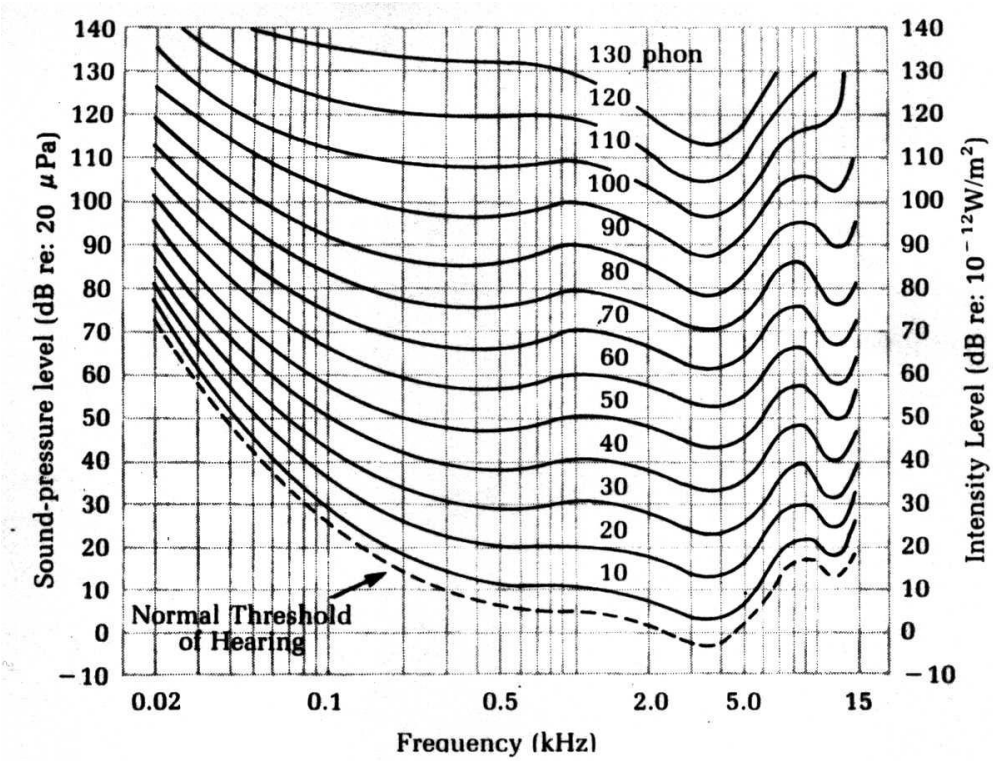

Figure 1: Fletcher & Munson Equivalent Noise Level Contour

Rajah 1: Kontur Paras Bunyi Setara Fletcher & Munson

3. (a). List **TWO (2)** sources of noise and briefly discuss **TWO (2)** of their impacts to the community.

*Senaraikan **DUA (2)** sumber bunyi bising dan bincangkan secara ringkas **DUA (2)** daripada kesannya kepada komuniti.*

[7 marks/*markah*]

(b). Describe **THREE (3)** types of sound with their respective sketch of wave and give **ONE (1)** example of each.

*Terangkan **TIGA (3)** jenis bunyi beserta lakaran gelombang dan berikan **SATU (1)** contoh untuk setiap satu.*

[12 marks/*markah*]

(c). List **THREE (3)** legislation/ guidelines of noise levels for ambient air in Malaysia.

*Senaraikan **TIGA (3)** jenis peraturan/ garis panduan bunyi bising untuk udara ambien di Malaysia.*

[6 marks/*markah*]

4. (a). A daytime traffic noise monitoring results are shown in **Table 1**.

*Keputusan pemantauan hingar lalu lintas waktu siang diberikan dalam **Jadual 1**.*

Table 1/ *Jadual 1*

Duration (minutes) Masa (minit)	Sound Level dB(A) Paras Bunyi dB(A)
15	75
30	73
45	71
60	74
75	75
90	77
105	69
120	66
135	70
150	71

(i). Define L_n.

Definisikan L_n.

[3 marks/*markah*]

(ii). Calculate L_{dn}.

Kirakan L_{dn}.

[5 marks/*markah*]

(iii). Determine L_{10}, L_{50} and L_{90}.

Tentukan L_{10}, L_{50} and L_{90}.

[10 marks/*markah*]

(b). A noise measurement exercise was carried out in front of a primary school to measure noise disturbance from construction site nearby the school during working hours. The monitoring produced data as shown in **Table 2**:

*Aktiviti pemantauan bunyi dilakukan di hadapan sebuah sekolah rendah untuk mengukur gangguan bunyi dari tapak pembinaan berhampiran sekolah tersebut semasa waktu bekerja. Pemantauan menghasilkan data seperti ditunjukkan dalam **Jadual 2**:*

Table 2/ *Jadual 2*

Time (minutes) *Masa (minit)*	10	20	30	40	50	60
Sound Pressure dB(A) *Tekanan bunyi dB(A)*	61	70	63	66	72	71

Calculate L_{Aeq} for the whole monitoring data and comment your answer.

Kirakan L_{Aeq} untuk seluruh data yang dipantau dan komen jawapan anda.

[7 marks/*markah*]

5. Workers in a motor vehicle spare parts factory lodge a complaint as they are constantly being exposed to noise from the machines in the plant. As a safety and health officer in charge in the plant:

Pekerja-pekerja di sebuah kilang membuat alat ganti kenderaan bermotor membuat aduan kerana sentiasa terdedah dengan bunyi bising daripada mesin-mesin yang terdapat dalam kilang itu. Sebagai seorang pegawai keselamatan dan kesihatan yang bertugas di kilang tersebut:

(a). Describe **THREE (3)** methods of noise control principles and give **ONE (1)** example of each.

*Jelaskan **TIGA (3)** kaedah prinsip pengawalan bunyi bising dan berikan **SATU (1)** contoh untuk setiap satu.*

[12 marks/*markah*]

(b). With appropriate examples, determine ways to reduce the level of noise exposed to the workers.

Dengan menyatakan contoh-contoh yang bersesuaian, tentukan langkah-langkah untuk mengurangkan paras bunyi bising yang terdedah kepada para pekerja tersebut.

[13 marks/*markah*]

APPENDIX/*LAMPIRAN*

Useful formulae/Formula berguna:

1) $C = 20.05\ T^{0.5}$

2) $I = w/s$

3) $L_I = 10 \log_{10} I/10^{-12}$

4) $Lp = 20 \log_{10} (P/Po)$, $Po = 20\ \mu Pa$

5) $Lw = 10 \log_{10} (w/10^{-12})$

6) $Leq = 10 \log_{10} \sum ti\ 10^{\ Li/10}$

7) $L_{wp} = 10 \log_{10} 1/N \sum 10^{\ (Lj/10)}$

8) $L_{pp} = 20 \log_{10} 1/N \sum 10^{\ (Lj/20)}$

9) $T_L = 10\log10 \left\{ \frac{s}{\tau 1 s1 + \ldots + \tau 2 s2} \right\}$

10) $T_L = 10 \log_{10} 1/\tau$

11) NNI = Average Peak Noise Level + $15 \log_{10} N - 80$
Average Peak Noise Level = $10 \log10\ 1/N \sum 10^{\ \text{Peak noise level }/10}$ dB (A)

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