

UNIVERSITI SAINS MALAYSIA

1st. Semester Examination
2003/2004 Academic Session
*Peperiksaan Semester Pertama
Sidang Akademik 2003/2004*

September / Oktober 2003

EAV 583/4 – Air and Noise Pollution Control

EAV 583/4 – Kawalan Pencemaran Udara dan Hingar

Duration: 3 hours

Masa : 3 jam

Instructions to candidates:

Arahan kepada calon:

1. Ensure that this paper contains **EIGHT (8)** printed pages including appendices.
Sila pastikan kertas peperiksaan ini mengandungi LAPAN (8) muka surat bercetak termasuk lampiran sebelum anda memulakan peperiksaan ini.
2. This paper contains **SIX (6)** questions. Answer **FIVE (5)** questions only. Marks will be given to the **FIRST FIVE (5)** questions put in order on the answer script and **NOT** the **BEST FIVE (5)**.
Kertas ini mengandungi ENAM (6) soalan. Jawab LIMA (5) soalan sahaja. Markah hanya akan dikira bagi LIMA (5) jawapan PERTAMA yang dimasukkan di dalam buku mengikut susunan dan bukannya LIMA (5) jawapan terbaik.
3. All questions **CAN BE** answered in English or Bahasa Malaysia or combination of both languages.
Semua soalan boleh dijawab dalam Bahasa Inggeris atau Bahasa Malaysia ataupun kombinasi kedua-dua bahasa.
4. Each question carry equal marks.
Tiap-tiap soalan mempunyai markah yang sama.
5. All question **MUST BE** answered on a new sheet.
Semua jawapan MESTILAH dijawab pada muka surat yang baru.
6. Write the answered question numbers on the cover sheet of the answer script.
Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.

1. (a) With the help of a sketch, explain how sound wave is generated and give the relation between velocity, frequency and wavelength of sound. (7 marks)

Dengan bantuan gambarajah, terangkan bagaimana gelombang bunyi terbentuk dan berikan kaitan di antara halaju, frekuensi dan jarak gelombang.

- (b) Averaged the Sound Power Level and the Sound Pressure Level from the following field data, 100 dB, 85 dB, 90dB, 75 dB and 64 dB using formula. (9 marks)

Puratakan Paras Kuasa Bunyi serta Paras Tekanan Bunyi bagi data lapangan yang berikut, 100 dB, 85 dB, 90dB, 75 dB dan 64 dB menggunakan kaedah formula.

- (c) Name **TWO** (2) main legislation pertaining to noise in Malaysia. (4 marks)

*Namakan **DUA** (2) perundangan utama tentang hingar di Malaysia.*

2. (a) In brief, explain the meaning of Noise level (Phone). (5 markah)

Terangkan secara ringkas pengertian Paras Hingar (Phon).

- (b) Give the difference between Cound Pressure Level and Sound Power Level. (5 marks)

Berikan perbezaan di antara Paras Tekanan Bunyi dan Paras Kuasa Bunyi.

- (c) Calculate the values of L₅₀ and L₉₅ for the following monitoring data:

Duration (Minutes)	Sound level dB (A)
10	71
20	75
30	70
40	78
50	80
60	84
70	60
80	66
90	67
100	70
110	65
120	67

(10 marks)

Kirakan nilai L_{50} dan L_{95} untuk keputusan pemantauan bunyi di bawah:

<i>Masa (Minit)</i>	<i>Paras Bunyi dB (A)</i>
10	71
20	75
30	70
40	78
50	80
60	84
70	60
80	66
90	67
100	70
110	65
120	67

3. (a) Discuss in brief **FOUR (4)** factors that influence sound propagation in open space (outdoor).
(6 marks)

*Bincangkan secara ringkas **EMPAT (4)** faktor yang mempengaruhi penyebaran bunyi di tempat terbuka (luar bilik).*

- (b) Describe methods that normally applied in controlling noise emission from construction activities.
(8 marks)

Terangkan kaedah-kaedah yang biasanya diaplikasikan dalam mengawal pelepasan bunyi dari aktiviti pembinaan.

- (c) A concrete wall is having a transmission coefficient, $\tau = 2.5 \times 10^{-2}$. Another wall (mortar) is having a transmission coefficient, $\tau = 2.5 \times 10^{-7}$. Calculate the noise reduction in dB for both walls.
(6 marks)

Suatu tembok konkrit mempunyai pekali penghantaran, $\tau = 2.5 \times 10^{-2}$. Suatu tembok yang lain (mortar) pula mempunyai pekali penghantaran, $\tau = 2.5 \times 10^{-7}$. Kirakan pengurangan hingar dalam dB untuk kedua-dua tembok tersebut

4. (a) What is lapse rate? Differentiate between ambient and adiabatic lapse rates.
(3 marks)

Apakah dimaksudkan kadar lelap? Bezakan di antara kadar lelap ambien dan kadar lelap adiaatik.

- (b) Explain the effect of lapse rate on plume behaviour with the help of suitable diagrams.
(7 marks)

Dengan bantuan gambarajah yang sesuai, terangkan kesan kadar lelap terhadap kelakuan plum.

- (c) Describe any **TWO (2)** of the following:
(i) Temperature profile of the atmosphere
(ii) Particulates
(iii) Acid rain
(iv) Primary and secondary pollutants
(10 marks)

*Terangkan mana-mana **DUA (2)** yang berikut:*

- (i) *Profil suhu atmosfera.*
(ii) *Zarah.*
(iii) *Hujan asid.*
(iv) *Pencemar primer dan sekunder.*

5. (a) A power plant burns 22,000 tonnes of coal per day. The coal has a sulphur content of 4.1 %. The combustion products are discharged through a stack whose physical height is 150 m. and the inside diameter is 6.5 m. The stack gas has a temperature of 150°C and an exit velocity of 20 m/s. The ambient air temperature is 15°C, the atmospheric pressure is 1 Bar and the average wind speed at the top of the stack is 4 m/s. Assuming stability class C, calculate:
- i. the effective stack height. (5 marks)
 - ii. the maximum ground-level concentration of SO₂. (5 marks)
 - iii. the distance from the stack at which the maximum SO₂ concentration occurs. (5 marks)
 - iv. the concentration of SO₂ at a distance of 2.5 km downwind from the plant and at a crosswind distance of 200 m. (5 marks)

Suatu loji janakuasa membakar 22,000 tan arang batu sehari. Arang batu mengandungi 4.1% sulfur. Produk pembakaran dilepaskan melalui paip tumpu dengan ketinggian fizikal 150m dan diameter dalaman 6.5m. Gas paip tumpu mempunyai suhu 150°C dan halaju keluar 20m/s. Suhu udara ambient adalah 15°C, tekanan atmosfera 1 Bar dan halaju purata angin pada puncak paip tumpu 4m/s. Dengan mengangap kestabilan kelas C, kirakan:

- (i) Tinggi efektif paip tumpu.
- (ii) Paras maksimum SO₂ di aras bumi.
- (iii) Jarak dari paip tumpu bila kepekatan maksimum SO₂ berlaku.
- (iv) Kepekatan SO₂ pada jarak 2.5 km dari loji mengikut arah angin dan pada jarak angin lintang 200m.

6. (a) A cyclone of standard proportions with a diameter of 2 m processes 8 m³/s of an air stream with a temperature of 60 °C. Determine:
- (i) the removal efficiency of a 10 μm particle with density of 1.5 g/cm³.
(5 marks)
 - (ii) the removal efficiency if a set of 42 multiple cyclones of diameter 30 cm each is used.
(5 marks)

Take viscosity of air as 1.9×10^{-5} kg/m.s.

- (a) Suatu siklon berkadaran standard dengan diameter 2m memproses 8m³/s aliran udara dengan suhu 60°C. Tentukan:
- (i) Kecekapan penyingkiran zarah 10μm dengan ketumpatan 1.5 g/cm³.
 - (ii) Kecekapan penyingkiran sekiranya 42 ciri siklon dengan diameter 30cm setiap satu digunakan.

Ambil kelikatan udara 1.9×10^{-5} kg/m.s.

- (b) Write notes on any **TWO (2)** of the following:
- (i) Electrostatic precipitator.
 - (ii) Venturi scrubber.
 - (iii) Gaseous contaminants removal by absorption.
 - (iv) Control of gaseous contaminants by combustion.
- (10 marks)

- (b) Tuliskan nota mana-mana **DUA (2)** yang berikut:
- (i) Pemendak elektrostatik.
 - (ii) Penyerap venturi.
 - (iii) Penyingkiran gas tercemar secara penjerapan.
 - (iv) Kawalan gas tercemar oleh pembakaran.

APPENDIX

Useful formulae:

1) $I = w/s$

2) $L_p = 20 \log_{10} (P/P_o)$, $P_o = 20 \mu\text{Pa}$

3) $L_w = 10 \log_{10} (w/10^{-12})$

4) $L_{eq} = 10 \log_{10} \sum t_i 10^{L_i/10}$

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

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

7) $T_L = 10 \log_{10} \left\{ \begin{matrix} s \\ \tau_1 s_1 + \dots + \tau_2 s_2 \end{matrix} \right\}$

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

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