UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2008/2009

November 2008

# EAP 583/4 – Air And Noise Pollution Control

Duration: 3 hours

Please check that this examination paper consists of **SIX (6)** pages of printed material including appendix before you begin the examination.

**Instructions**: Answer **FIVE (5)** questions. All questions carry the same marks.

You may answer the question either in Bahasa Malaysia or English.

All questions **MUST BE** answered on a new sheet.

Write the answered question numbers on the cover sheet of the answer script.

1. (a) Draw a sinusoidal curve of sound wave and label all the important parameters.

[6 marks]

(b) Calculate the wavelength of a given sound at air temperature of 303 K and frequency 5,000 Hz.

[6 marks]

(c) (i) Briefly define A-Weighted Sound Pressure Level.

[3 marks]

(ii) Calculate the A-Weighted Sound Pressure Level for a sound pressure of $10N/m^2$.

[5 marks]

2. (a) With the help of a sketch, define Impulse Noise Type B.

[5 marks]

(b) Calculate the value of Traffic Noise Index (TNI) from the following monitoring data:

| **Time (minutes)** | **Lp, dB (A)** |
|---|---|
| 10 | 84 |
| 20 | 92 |
| 30 | 78 |
| 40 | 83 |
| 50 | 90 |
| 60 | 84 |
| 70 | 77 |
| 80 | 78 |
| 90 | 82 |
| 100 | 90 |

[15 marks]

3. (a) Predict the Leq from following data:

| | |
|---|---|
| Volume of cars | 350 vehicles/hour |
| Volume of 6 tires truck | 80 trucks/hour |
| Distance to receiver | 20 m |
| Average speed of vehicle | 68 km/hour |

[4 marks]

(b) Name **THREE (3)** methods for reducing noise at receiver. Briefly discuss **ONE (1)** of them.

[8 marks]

(c) Calculate the transmission loss coefficient for a thick wall with noise reduction of 60 dB (A).

[3 marks]

(d) Sketch the possible noise path through a barrier (wall).

[5 marks]

4. (a) Air pollutant emitted from motor vehicles exhaust contributes mainly to air pollution loading in Malaysia. It was estimated that 27 millions vehicles were registered with 70% running on Malaysian road network, whereby half of these are believed to be cars. Calculate exhaust emissions of cars from 15 km of a dual carriageway bridge. It was estimated that 5 g/km hydrocarbons were emitted from a car on a clear day.

[10 marks]

(b) Notion that vehicles emissions can be reduced by management and engineering control has been in place for quite sometime. Draw framework to reduce air pollutions derived from vehicles exhaust especially in urban areas. Your discussion should include both control measures for short and long term strategy.

[10 marks]

5. (a) Calculate the concentrations of Sulphur dioxide at ground level open area at points located 1.0, and 2.0km downwind in bright and stable atmospheric condition emitted from a stack of a coal fired power station, with daily mass of solid fuel burned 5000 tonne. The stack is 50 m height with internal radius of 10 m, exit velocity of 20 m/s at temperature 373 K. Wind velocity at 10 m is 12 m/s. Given sulphur content of solid fuel is 2.4%.

[10 marks]

(b) Haze events normally occur during dry season. It is aggravated by transboundary as well as local air pollutions. Air pollution potential plays a major role in creating forming haze conditions. Describe air pollution potential in relation with Malaysian locations and climate conditions.

[10 marks]

6. (a) Discuss the effects of increasing air pollutions on building materials by giving appropriate examples.

[10 marks]

(b) Clearly, describe methods for measuring criteria gases in ambient air.

[10 marks]

## APPENDICE

Useful formulae:

C $= 20.05T^{1/2}$

I $= w/s$

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

Lp $= 20 \log_{10} (P/Po)$, Po = 20 μPa

Weighted Lp $= 10 \log_{10} (P/Po)$, Po = 20 μPa

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

Leq $= 10 \log_{10} \Sigma ti \; 10^{Li/10}$

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

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

$T_L$ $= 10 \log_{10} \left\{ \frac{s}{\tau 1 s1 + .... + \tau_n s_n} \right\}$

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

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

Traffic Leq $= 42.3 + 10.2 \log (Vc + 6\ Vt) - 13.9 \log D + 0.13\ S$

Traffic Ldn $= 31.0 + 10.2 \log [AADT + T\%\ AADT/20)] - 13.9 \log D + 0.13\ S$

$L_{NP}$ $= Leq + (L_{10} - L_{90})$

TNI $= 4 (L_{10} - L_{50}) + L_{90} - 30$

## APPENDICE

$\sigma_z$ (stability class C) = $0.08x\ (1 + 0.0001x)^{-0.5}$

$\sigma_z$ (stability class D) = $0.06x\ (1 + 0.0001x)^{-0.5}$

$\sigma_z$ (stability class F) = $0.04x\ (1 + 0.0001x)^{-0.5}$

$\sigma_y$ (stability class C) = $0.11x\ (1 + 0.0001x)^{-0.5}$

$\sigma_y$ (stability class D) = $0.08x\ (1 + 0.0001x)^{-0.5}$

$\sigma_y$ (stability class F) = $0.16x\ (1 + 0.0003x)^{-1}$

$$Fb = W_o R_o^2 \quad g \quad (Tpo-Tao)$$
$$Tpo$$

$$q(x,0,0) = \frac{Q}{л\ ū\ \sigma_z\ \sigma_y} \exp\left[\frac{-H^2}{2\sigma_z^2}\right]$$

$$q(x,y,0) = \frac{Q}{л\ ū\ \sigma_z\ \sigma_y} \exp -\left[\frac{y2}{2\sigma_y^2} + \frac{H^2}{2\sigma_z^2}\right]$$

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