UNIVERSITI SAINS MALAYSIA

1st. Semester Examination
2004/2005 Academic Session

October 2004

EAP 583/4 – Air and Noise Pollution Control

Duration : 3 hours

Instructions to candidates:

1. Ensure that this paper contains **FIVE (5)** printed pages, including appendices, before you start your examination.

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).**

3. All questions carry equal marks.

4. All questions **MUST BE** answered in English.

5. Each question **MUST BE** answered on a new sheet.

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

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1. (a) Give measurement principal for **FIVE (5)** criteria pollutants which comply with USEPA standards.

(5 marks)

(b) Calculate concentrations of Sulphur Dioxide (SO_2) at ground level, 2.3 kilometer downwind during cloudy weather condition emitted from a stack of a coal fired power station, if given the emission rate for SO_2 is 972 gs^{-1}, effective stack height is 314 m, and windspeed at stack height is 11.3 ms^{-1}. (in μgm^{-3}).

(8 marks)

(c) Give all assumptions when using Gaussian model. Briefly, discuss the importance of this model towards understanding dispersions of pollutants in the atmosphere.

(7 marks)

2. (a) Lists the general sources of indoor air pollutants in buildings and houses. Give the factors that influence the concentrations of the pollutants.

(7 marks)

(b) Describe air infiltration routes and types into a building. Explain the effects of infiltration in influencing the increments and reductions of air pollutants.

(5 marks)

(c) Discuss Tobacco Combustions and their common health effects to human within indoor environment.

(8 marks)

3. (a) Choose one criteria pollutant and discuss the possible sources, prevalence, detections and control methods.

(10 marks)

(b) Describe quantification methods for traffic or stack emissions.

(10 marks)

4. (a) Sketch and explain how sound wave is generated. Indicate the main parameters of sound wave in your answer.

(5 marks)

(b) Derive that Sound Pressure Level can be written as $Lp = 20 \log_{10} (P/Po)$.

(5 marks)

(c) Determine the sound pressure level from combining the following four levels: 71, 48, 56, 68 dB using formula.

(5 marks)

(d) If a sound source has a pressure of 5,000 μPa at 10 m distance, compute:
(i) the sound power level.
(ii) the sound intensity level.

(5 marks)

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

(b) Calculate the values of Leq, L_{10} and L_{90} 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)

(c) Predict the Leq in dB (A) for the following traffic data:

Total volume of vehicle per hour = 500
Volume of car per hour = 60% of the total vehicle
Volume of trucks (six or more tires) per hour = 10% of the total vehicle
Distance from edge of pavement to receiver = 10 m
Average speed of traffic flow during one hour monitoring = 60 km/hr

(5 marks)

6. (a) In brief, explain **FIVE (5)** main applications of noise monitoring in environmental engineering.

(5 marks)

(b) Total number of flight (departure and arrival) at a medium size airport is 120. If the measured peak noise levels are 135 dB (A) and 128 dB (A), respectively, determine the Noise Number Index (NNI) of this airport.

(5 marks)

(c) A concrete wall is having a transmission coefficient, $\tau=3.0\text{x}10^{-2}$. Another wall (mortar) is having a transmission coefficient, $\tau=2.5\text{x}10^{-5}$. Calculate the noise reduction in dB for both walls.

(5 marks)

(d) An industrial complex operates at 80 dB for 5 hours per day and at 65dB for three hours per day. Determine whether the workers of this industry work in a safer noise level.

(5 marks)

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APPENDIX

APPENDICE/LAMPIRAN

Useful formulae:

1) $I = w/s$

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

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

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

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

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

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

8) $T_L = 10\log_{10} \left\{ \frac{s}{\tau 1 s1 + ... + \tau 2 s2} \right\}$

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

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

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

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

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

14) $D = C_1/T_1 + C_2/T_2 + ... + C_n/T_n$