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UNIVERSITI SAINS MALAYSIA

1<sup>st</sup>. Semester Examination  
2004/2005 Academic Session

October 2004

**EAP 583/4 – Air and Noise Pollution Control**

Duration : 3 hours

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**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.

1. (a) Give measurement principal for FIVE (5) criteria pollutants which comply with USEPA standards. (5 marks)
- (b) Calculate concentrations of Sulphur Dioxide ( $\text{SO}_2$ ) 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  $\text{SO}_2$  is  $972 \text{ gs}^{-1}$ , effective stack height is 314 m, and windspeed at stack height is  $11.3 \text{ ms}^{-1}$ . (in  $\mu\text{gm}^{-3}$ ). (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  $L_p = 20 \log_{10} (P/P_0)$ . (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  $5,000 \mu\text{Pa}$  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,  $\tau=3.0 \times 10^{-2}$ . Another wall (mortar) is having a transmission coefficient,  $\tau=2.5 \times 10^{-5}$ . 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)

APPENDIX

APPENDICE/LAMPIRAN

Useful formulae:

1)  $I = w/s$

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

3)  $L_p = 20 \log_{10} (P/P_0), P_0 = 20 \mu\text{Pa}$

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

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

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

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

8)  $T_L = 10 \log_{10} \left\{ \frac{s}{\tau_1 s_1 + \dots + \tau_2 s_2} \right\}$

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

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

11)  $\text{Traffic } L_{eq} = 42.3 + 10.2 \log (V_c + 6 V_t) - 13.9 \log D + 0.13 S$

12)  $\text{Traffic } L_{dn} = 31.0 + 10.2 \log [AADT + T\% AADT/20] - 13.9 \log D + 0.13 S$

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

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