UNIVERSITI SAINS MALAYSIA

1st. Semester Examination
2005/2006 Academic Session

November 2005

EAP 583/4 – Air and Noise Pollution Control

Duration: 3 hours

Instructions to Candidates:

1. Ensure that this paper contains **FOUR (4)** printed pages 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. Each question carry equal marks.

4. All questions **CAN BE** answered in English or Bahasa Malaysia or combination of both languages.

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) List **THREE (3)** common types of sound.

(3 marks)

(b) Field monitoring of sound pressure level gives the following data:

Time (minutes)	**Sound Pressure dB (A)**
10	84
20	76
30	74
40	75
50	74
60	75
70	77
80	78
90	60
100	65
110	80
120	72

(i) Calculate the value of Equivalent Sound Level, $Leq_{(1\ hour)}$.

(7 marks)

(ii) Calculate the Day and Night Sound Level, Ldn, if the monitoring was done at 10.30 pm.

(4 marks)

(c) Describe **THREE (3)** permissible exposure limits for employees under the Factories and Machinery (Noise Exposure) Regulations 1989, under the Factory and Machinery Act 1967

(6 marks)

2. (a) Briefly describe **TWO (2)** guidelines of an ambient noise levels in Malaysia.

(4 marks)

(b) Average the Sound Pressure Level and Sound Power Level of 80 dB (A), 95 dB (A) and 90 dB (A) using Formula.

(6 marks)

(c) A concrete wall is having a transmission coefficient of $\tau = 2x10^{-5}$. Calculate the noise reduction in dB for this wall.

(4 marks)

2. (d) Predict the Leq in dB (A) for the following traffic data:

Total volume of vehicle per hour = 1,000
Volume of car per hour = 55% of the total vehicle
Volume of trucks (six or more tires) per hour = 20% 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

(6 marks)

3. (a) With the help of a sketch, explain the measurement procedures of an exhaust noise from a motorcycle in Malaysia, as given in the Third Schedule of the Environmental Quality (Motor Vehicle Noise) Regulations 1987, under the Environmental Quality Act 1974.

(7 marks)

(b) Given that a Sound Pressure Level from a generator is 90 dB. Determine the sound intensity and sound intensity level which will be heard by a person who stands 20 m away of the source.

(8 marks)

(c) Calculate the sound pressure in N/m^2 release by the same level of a noise source with sound power of $1x10^{-3}$ watt.

(5 marks)

4. (a) Give the relevant legislation related to air pollution control in Malaysia. Discuss the effectiveness of this legal instrument in dealing with the air pollution problems within the boundary of local authority.

(10 marks)

(b) On what interrelated factors the atmospheric dispersion of pollutants released through vents and stacks depends?

(4 marks)

(c) The down-wind centre-line concentration of sulphur dioxide at ground level at a distance of one kilometre from a ground-level point source is 180 $\mu g/m^3$. Compute the safe height of a stack (considering both without and with reflection) needed at the source to reduce the sulphur dioxide concentration at the same location (one kilometre from the source) to below the recommended limit of 60 $\mu g/m^3$ (ambient air quality standard). The horizontal and vertical standard deviations for the Gaussian model at one kilometre away and the prevailing atmospheric condition (neutral class stability) are 75 m and 32 m, respectively.

(6 marks)

5. (a) List five basic classes of particulate collection equipment and the situations under which each is more effective.

(10 marks)

(b) Explain the working principle of an electrostatic precipitator.

(5 mark)

(c) A 1000-MW pulverised coal-fired steam power plant of 38 percent thermal efficiency uses coal with an ash content of 14 percent and heating value of 26,700 kJ/kg. Assume that 75 percent of the ash goes up the stack as particulate in the flue gas. The particulate emission is controlled by an electrostatic precipitator. The weight distribution of the particles in the flue gas and the removal efficiencies of the electrostatic precipitator are shown. Determine the amount of fly ash emitted, in kilograms per second, with the flue gas. [1 MW = 1000 kJ/s]

Particle size, μm	0-5	5-10	10-20	20-40	>40
Weight, percent	12	16	22	27	23

Particle size, μm	0-5	5-10	10-20	20-40	>40
Removal, percent	70	92.5	96	99	100

(5 marks)

6. (a) Explain the importance of horizontal and vertical mixing in the dispersion of air pollutants.

(5 marks)

(b) Discuss one technique for sampling and measuring a named gaseous pollutant.

(3 marks)

(c) Discuss the formation of the **THREE (3)** different types of temperature inversions.

(6 marks)

(d) With the help of diagrams, explain the formation for the following plumes:
(i) Looping
(ii) Lofting
(iii) Fumigation

(6 marks)

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