UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua
Sidang Akademik 2006/2007

April 2007

EAP 412/4 – PENGAJIAN ALAM SEKITAR

Masa : 3 jam

Please check that this examination paper consists of TEN pages of printed material including appendices before you begin the examination.
[Sila pastikan kertas peperiksaan ini mengandungi SEPULUH muka surat bercetak termasuk lampiran sebelum anda memulakan peperiksaan ini.]

Instructions: Answer **FIVE** (5) questions only. All questions carry the same marks.
*[**Arahan**: Jawab **LIMA** (5) soalan sahaja. Semua soalan membawa jumlah markah yang sama.]*

You may answer the question in English except one question should be answered in Bahasa Malaysia.
[Anda dibenarkan menjawab soalan dalam Bahasa Inggeris kecuali satu soalan mestilah dijawab dalam Bahasa Malaysia.]

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] By using the root mean square principles, prove that Sound Pressure Level can be written as:

$$L_p = 20 \log_{10} (P/P_o)$$

where, P_o is the reference Sound Pressure.

(5 marks)

Dengan menggunakan prinsip punca purata kuasa dua, buktikan bahawa Paras Tekanan Bunyi boleh ditulis sebagai:

$$L_p = 20 \log_{10} (P/P_o)$$

di mana, P_o adalah Tekanan Bunyi Rujukan.

[b] Calculate the Average Sound Power Level for sound levels 38 dB, 78 dB and 51 dB using formula method.

(5 marks)

Kirakan Paras Kuasa Bunyi Purata untuk sumber bunyi 38 dB, 78 dB dan 51 dB menggunakan kaedah Formula.

[c] Calculate the Sound Intensity Level (L_I) that is heard by someone who stands 5m away from the average sound in the question (b).

(6 marks)

Kirakan nilai Paras Keamatan Bunyi (L_I) yang didengari oleh seseorang yang berdiri 5 m dari bunyi purata dalam soalan (b).

[d] Taman Anggerik is separated by a 3 m hoarding built by Kontraktor Murni who is involved in the construction of a 4-storey school building adjacent to this Taman. Suggest **FOUR (4)** suitable methods that can be implemented by this contractor to abate noise pollution for Taman Anggerik.

(4 marks)

*Taman Anggerik hanya dipisahkan oleh dinding penghadang setinggi 3 m yang didirikan oleh Kontraktor Murni yang terlibat dengan projek pembinaan sebuah sekolah baru 4 tingkat bersebelahan. Cadangkan **EMPAT (4)** kaedah yang boleh dilakukan oleh pihak kontraktor ini dalam mengawal pencemaran bunyi ke Taman Anggerik.*

2. [a] Define Noise Number Index (NNI).

(5 marks)

Takrifkan Nombor Indeks Bunyi (NNI).

[b] Total number of flights (departing and arriving) at an airport is 95. If the measured peak noise levels are 135 dB (A) and 130 dB (A), determine the value of NNI at this airport.

(6 marks)

Jumlah penerbangan (berlepas dan mendarat) di sebuah lapangan terbang adalah 95. Sekiranya nilai bunyi puncak yang diukur adalah 135 dB (A) dan 130 dB (A), tentukan nilai NNI di lapangan terbang ini.

[c] Field monitoring of sound pressure level gives the following data:

Penentuan bunyi di suatu kawasan pembinaan memberikan data seperti berikut:

Masa (Time) Minit (minutes)	Paras Bunyi dB (A) (Sound Level) dB (A)
10	94
20	86
30	84
40	85
50	84
60	85
70	87
80	88
90	70
100	75
110	90
120	82

Calculate the value of Equivalent Sound Level, Leq (1 hour).

Kirakan nilai Paras Bunyi Setara, Leq (1 jam).

(5 marks)

[d] Give **TWO (2)** permissible exposure limits for employees under the Factories and Machinery (Noise Exposure) Regulations 1989, Factory and Machinery Act 1967.

(4 marks)

*Berikan **DUA (2)** had dedahan yang dibenarkan kepada pekerja dalam Perundangan Kilang dan Jentera (Dedahan Bunyi) Perundangan 1989, di bawah Akta Kilang dan Jentera 1967.*

3. [a] Give scale index and status for air quality. Identify the critical index value according to recommended Malaysian Air Quality Guidelines and give the critical concentration value for PM_{10}.

(5 marks)

Berikan skala indeks kualiti udara dan status kualiti udara bagi setiap skala tersebut. Kenalpasti nilai indeks kritikal yang berkaitan dengan nilai Garispanduan Kualiti Udara Malaysia dan berikan kepekatan kritikal bagi pencemar PM_{10}.

[b] Explain briefly the method for vehicles emission control and its implementation in Malaysia.

(5 marks)

Terangkan dengan ringkas kaedah kawalan emisi kenderaan dan perlaksanaannya di Malaysia.

[c] List **FIVE (5)** factors contributing to good air quality management.

(5 marks)

*Senaraikan **LIMA (5)** faktor yang menyumbang kepada pengurusan kualiti udara yang baik.*

[d] List **FIVE (5)** types of instruments to determine the concentration of pollutants in a gas sample.

(5 marks)

*Senaraikan **LIMA (5)** jenis peralatan yang boleh digunakan untuk mengukur kepekatan pencemaran di dalam sesuatu sampel gas.*

4. [a] Initial Buoyancy Flux F_b can be determined by an air quality engineer by measuring the initial plume speed W_o, stack perimeter R_o, initial plume temperature T_{po}, and ambient temperature at stack height T_{ao}. State the formula to calculate F_b.

(2 marks)

Flux pengapungan awal (F_b) boleh ditentukan oleh jurutera kualiti udara dengan mengukur halaju plume awal W_o, perimeter cerobong R_o, suhu awal plum asap ketika dibebaskan T_{po}, dan suhu ambient pada ketinggian cerobong T_{ao}. Nyatakan formula untuk mengira F_b.

4. [b] Knowledge of the value of F_b enables an air quality engineer to determine the value of ***dh***. Give the threshold value of F_b and state the formula to calculate ***dh*** in relation to F_b.

(3 marks)

*Pengetahuan mengenai nilai F_b membolehkan seseorang jurutera kualiti udara menentukan nilai **dh**. Berikan nilai ambang bagi F_b dan nyatakan formula perkiraan **dh** berkaitan dengan nilai F_b.*

[c] A smoke stack has 20 m height and 5 m radius. The smoke exit velocity is 20 m/s at temperature 180°C. Wind speed at 20 meter height is 10 m/s and ambient temperature is 35°C. Daily coal burning rate is 3000 tonnes. The average sulphur content in coal is 2%. Calculate SO_2 concentration at a receptors located at 1 km, 2km and 6 km during overcast weather. The F_b value is 1570 m^4s^{-3}.

(15 marks)

Satu cerobong asap setinggi 20 m dengan perimeter 5 m. Halaju keluaran asap ialah 20 m/s dengan suhu 180°C. Halaju angin pada 20 m ialah 10 m/s dengan suhu ambien 35°C. Pembakaran arang batu ialah pada kadar 3000 ton sehari. Kandungan purata sulfur dalam arang batu adalah 2%. Kira kepekatan SO_2 pada jarak reseptor 1 km, 2 km dan 6 km ketika cuaca mendung. Diketahui nilai F_b ialah 1570 m^4s^{-3}.

5. [a] Describe the pure compound approach for the classification of hazardous wastes.

(5 marks)

Terangkan pendekatan sebatian tulin dalam pengkelasan sisa berbahaya.

[b] Explain the 5Rs concept of waste management.

(5 marks)

Terangkan konsep 5R dalam pengurusan sisa.

[c] List **FIVE (5)** advantages of anaerobic biological treatment processes over aerobic processes.

(5 marks)

*Senaraikan **LIMA (5)** kebaikan dalam proses rawatan biologi anaerobic berbanding aerobic.*

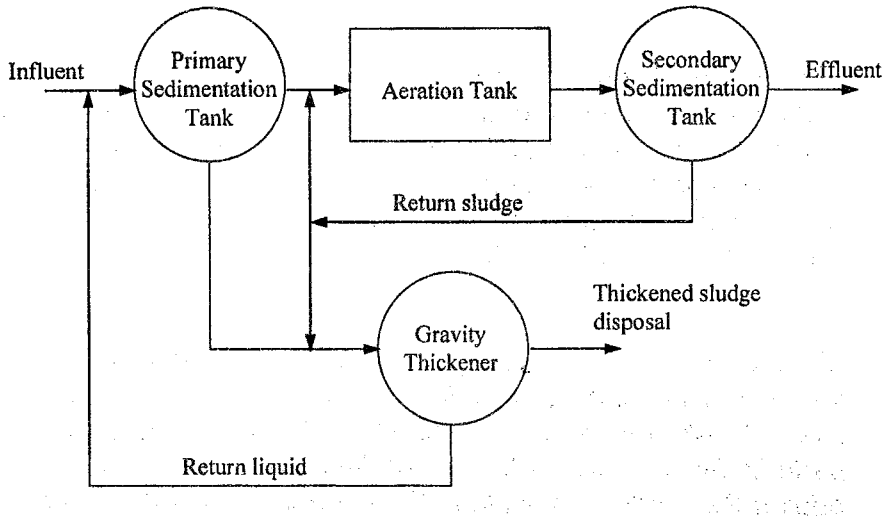
[d] Describe sludge thickening by floatation.

(5 marks)

Terangkan penebalan enapcemar secara pengapungan.

6. An industrial wastewater is treated in a treatment plant whose schematic diagram is shown below:

Air sisa industri dirawat di loji olahan berdasarkan rajah skematik berikut.



The following information is known:

Diameter of primary sedimentation tank	= 30 m
Volume of aeration tank	= 4000 m^3
Mixed liquor suspended solids in aeration tank	= 2500 mg/l
Influent suspended solids to the plant	= 500 mg/l
Influent BOD to the plant	= 600 mg/l
Effluent BOD from the plant	= 50 mg/l
Wastewater flow to the plant	= 12 000 m^3/d
Primary sedimentation tank sludge solids	= 4 %
Secondary sedimentation tank sludge solids	= 0.8 %
Gravity thickener sludge solids	= 6 %

Maklumat adalah seperti berikut:

Diameter tangki enapan prima	*= 30 m*
Isipadu tangki	*= 4000 m^3*
Likur tercampur pepejal terampai dalam tangki pengudaraan	*= 2500 mg/l*
Influen pepejal termapai	*= 500 mg/l*
Influen BOD	*= 600 mg/l*
Effluen BOD	*= 50 mg/l*
Kadaralir air sisa	*= 12 000 m^3/d*
Pepejal enapcemar tangki endapan prima	*= 4 %*
Enapcemar pepejal tangki endapan sekunder	*= 0.8 %*
Enapcemar pepejal peringkat graviti	*= 6 %*

Determine:
Tentukan:

[a] (i) The mass and volumetric loading rates to the thickener.
(8 marks)

Nilai jisim dan volumatrik kadar beban isipadu ke penebal.

(ii) The percent volume reduction by the gravity thickener.
(2 marks)

Peratusan pengurangan isipadu penebal graviti.

[b] Give recommendations for the installation and operation of a clinical waste storage area.
(5 marks)

Sarankan pemasangan dan pengoperasian untuk kawasan storan sisa.

[c] List **FIVE (5)** functions that a landfill cover should be able to perform.
(5 marks)

*Senaraikan **LIMA (5)** fungsi penutup kambus tanah.*

APPENDIX

Formula:

$$\sigma y = 0.08x\ (1+ 0.0001x)^{-0.5}$$
$$\sigma z = 0.06x\ (1+ 0.00015x)^{-0.5}$$

$$dh = \frac{39\ (Fb)^{0.6}}{U_h}$$

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) $Leg = 10 \log_{10} \Sigma ti\ 10^{Li/10}$

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

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

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 = $10 \log 10\ 1/N\ \Sigma\ 10^{\text{Peak noise level }/10}$ dB (A)

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

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

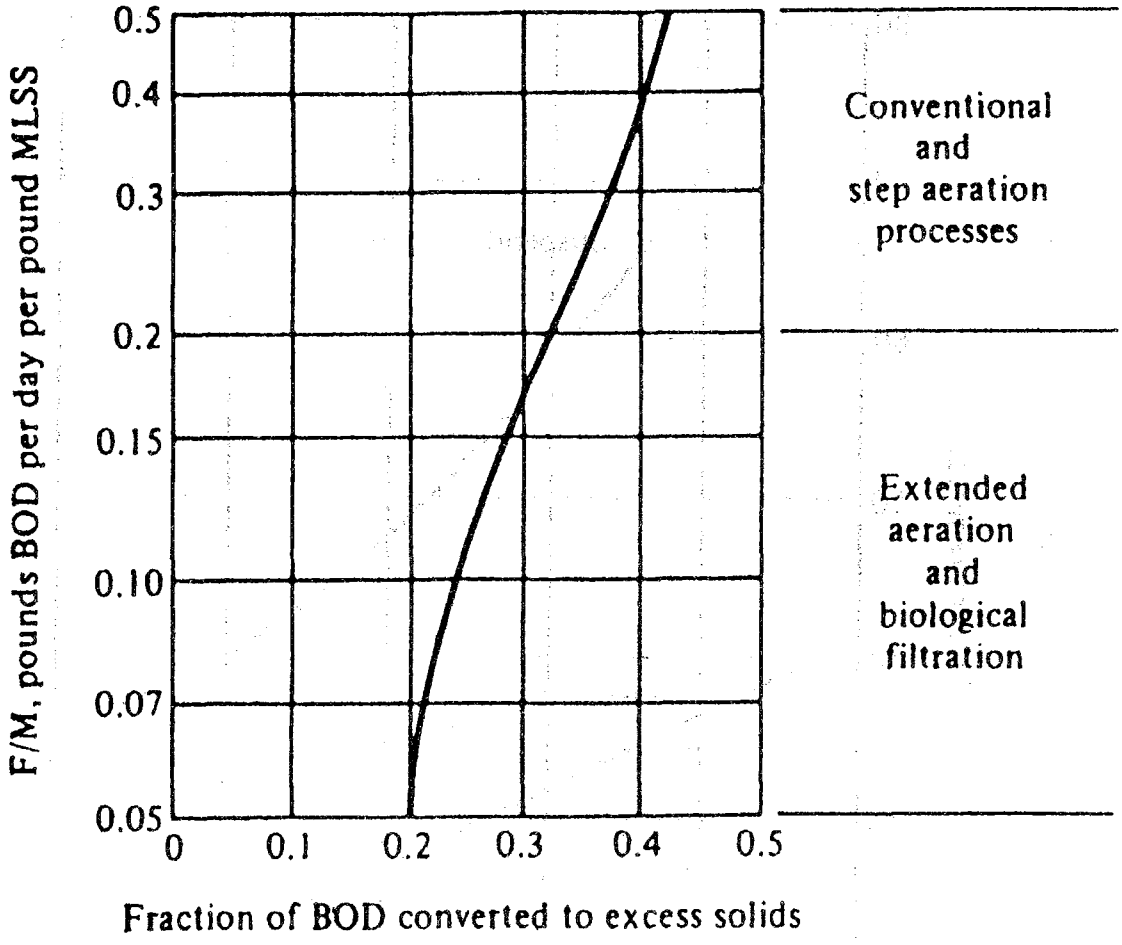


Figure 1 – Excessive sludge production v. F/M ratio

APPENDIX

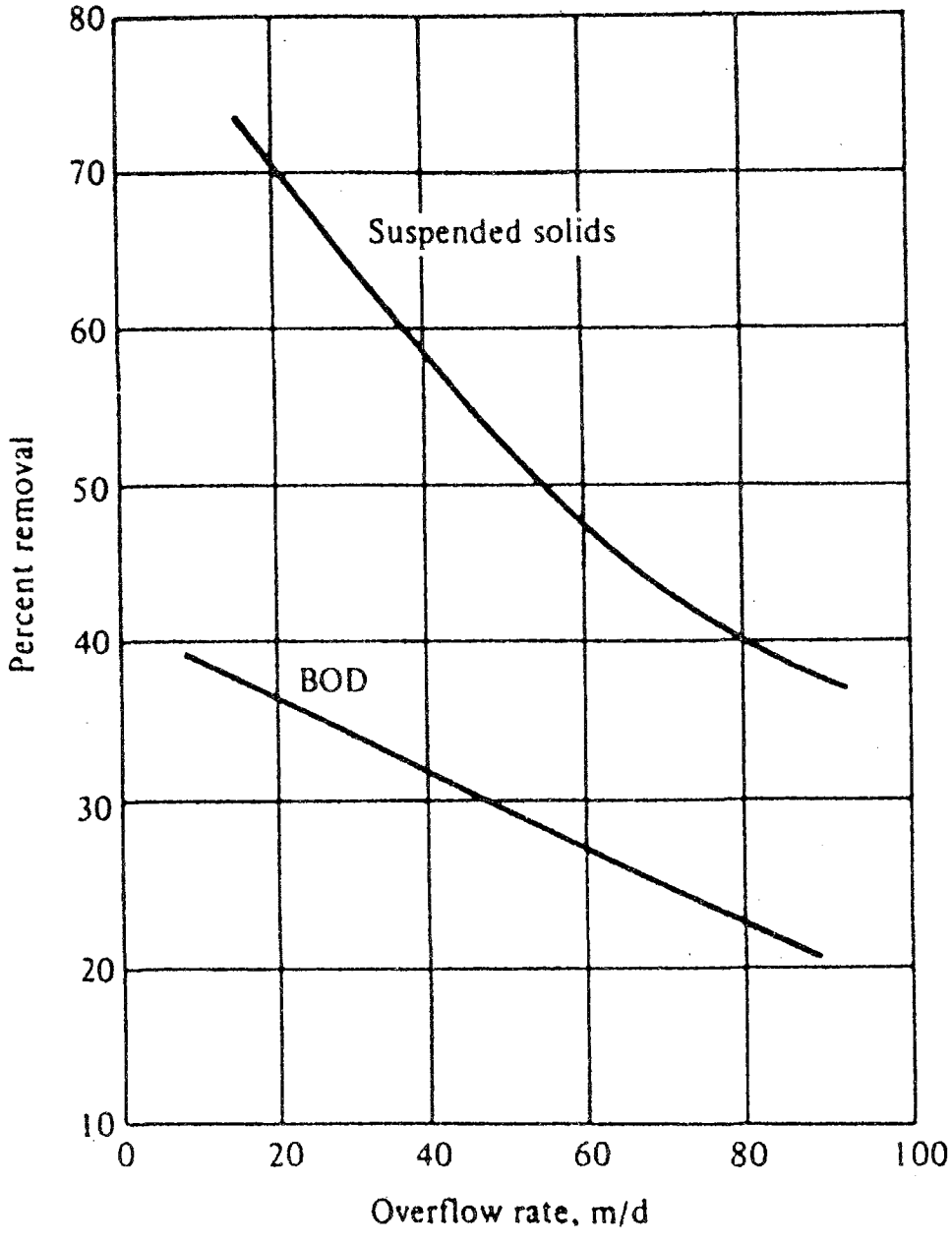


Figure 2 – Suspended solids and BOD removal as a function of surface overflow rate

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