UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2010/2011

November 2010

EBS 429/3 – Environmental Engineering
[Kejuruteraan Alam Sekitar]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains ELEVEN printed pages before you begin the examination.
[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

This paper consists of SEVEN questions.
[Kertas soalan ini mengandungi TUJUH soalan.]

Instruction: Answer **FIVE** questions. If candidate answers more than five questions only the first five questions answered in the answer script would be examined.
*[**Arahan**: Jawab **LIMA** soalan. Jika calon menjawab lebih daripada lima soalan hanya lima soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.]*

The answers to all questions must start on a new page.
[Mulakan jawapan anda untuk semua soalan pada muka surat yang baru.]

You may answer a question either in Bahasa Malaysia or in English.
[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]

In the event of any discrepancies, the English version shall be used.
[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]

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1. [a] Appraise the importance of the **Air Quality Index** (AQI) **System** and its significance to assess the health of the community? Explain how the concentration and the corresponding health effects of the following **gaseous pollutants** can affect the workers at your work site:

(i) carbon monoxide,

(ii) sulphur dioxide,

(iii) nitrogen oxides.

*Nilaikan kepentingan **Sistem Indeks Kualiti Udara** (AQI) dan tetapkan apakah kesannya kepada kesihatan masyarakat? Bincangkan bagaimana nilai kepekatan dan kesannya daripada segi kesihatan **pencemaran gas** yang berikut kepada pekerja dalam tapak tempat kerja anda:*

(i) Karbon monoksida,

(ii) Sulfur dioksida,

(iii) Nitrogen oksida.

(15 marks/*markah*)

[b] Evaluate the health effects of carbon monoxide (CO) concentration in the blood, **percentage carboxyhaemoglobin (% HbCO)**, of your worker after 1 hour of maintenance work if the concentration of CO at the workplace has reached the ambient standard of 35 ppm and that the value of the physical activity level, α, has value 2. Based on the acceptable health effects of CO concentration, assess whether the **performance of your worker** is affected in this case.

Tentukan kesannya kepekatan gas karbon monoksida dalam darah, ***peratus karboxyhaemoglobin (% HbCO)****, untuk pekerja anda selepas melaksanakan tugas penyenggaraan untuk tempoh 1 jam jika kepekatan gas CO di tempat kerja ini telah sampai ke tahap 35 bahagian per juta (ppm) dan nilai aktiviti fizikal ditetapkan pada nilai 2. Daripada hasil pengiraan anda dalam penentuan % HbCO, tentukan adakah* ***prestasi pekerja*** *terjejas dalam kes ini.*

(5 marks/*markah*)

2. [a] Recommend, with diagrams, two types of suitable equipment which can be used for **dust monitoring** at a work site and describe how they work. Discuss also the other **additional laboratory analytical tests** that need to be carried out for assessing the characteristics of the dust collected from the work site.

*Syorkan, dengan gambarajah, dua jenis **sistem pengawasan debu** di industri dan kaedah pengendaliannya di tempat kerja. Huraikan **kajian analisis makmal tambahan** yang perlu dilaksanakan dalam penilaian ciri-ciri debu yang didapati daripada tapak kerja.*

(10 marks/*markah*)

[b] Select, and explain their work mechanisms with diagrams, 3 different types of **dust control equipment** useful for the removal of dust from any dust generating industrial processes. **Rate their performance** and effectiveness in carrying out their dust control task.

*Pilih, dan beri penerangan dengan gambarajah mekanisma kegunaannya, 3 jenis peralatan dalam industri yang sesuai untuk **pengawalan debu** daripada proses industri. **Nilaikan prestasi** dan kesesuaiannya dalam pelaksanaan tugas pengawalan debu.*

(10 marks/*markah*)

3. [a] Explain the significance of **Water Quality Standards.** Appraise, with diagrams, the complete **Water Treatment Process** to produce clean drinking water for the industrial site and local community from a water catchment area.

Bincangkan kepentingannya ***Piawai Kualiti Air.*** *Tafsirkan, dengan gambarajah,* ***Proses Perawatan Air*** *yang lengkap untuk pengeluaran air minuman yang bersih untuk sesuatu tapak industri dan masyarakat tempatan daripada kawasan tadahan air.*

(15 marks/*markah*)

[b] Calculate the **settling velocity of particles** in a water treatment settling unit with the following characteristics:

Water temperature = 20 ^{o}C
Average diameter of settling particles = 0.05 mm
Specific gravity of particle = 1.2
Kinetic viscosity = 1.01 centi stokes.

Tentukan nilai ***halaju pengenapan zarah*** *untuk unit pengenapan untuk sistem perawatan air yang mempunyai ciri-ciri berikut:*

Suhu air = 20 ^{o}C
Purata garis pusat saiz zarah = 0.05 mm
Graviti tentu saiz zarah = 1.2
Kelikatan kinematik = 1.01 centi stokes.

(5 marks/*markah*)

4. [a] Assess how **noise pollution** affects hearing and discuss the efficiency of various noise control techniques for reducing excessive noise levels at either a factory or quarry.

*Nilaikan kesannya **pencemaran hingar** kepada pendengaran pekerja dan huraikan kecekapan pelbagai teknik pengawalan hingar.*

(10 marks/*markah*)

[b] Calculate the **average sound level at a work site** from 5 measurements obtained with the following values: 30 dB, 50 dB, 55dB, 70 dB and 65 dB.

Upon reference to the table with the maximum sound level allowable given below, what is the **maximum period** that a worker can carry out his duties at the above work site?

Sound level (dB)	Max. duration/day (hr)
90	8
92	6
95	4
100	2
105	1
110	0.5
115	0.25

Tentukan ***nilai purata aras hingar*** *di tempat kerja berikut yang mempunyai hingar daripada 4 punca yang bernilai: 38 dB, 51 dB, 68dB dan 78 dB.*

Berdasarkan jadual aras hingar maksima yang berikut, sebutkan berapa lama ***tempoh maksima yang selamat*** *untuk seseorang pekerja dibenarkan bertugas di kawasan tempat kerja tersebut.*

Aras hingar (dB)	*Tempoh maksima/hari (jam)*
90	*8*
92	*6*
95	*4*
100	*2*
105	*1*
110	*0.5*
115	*0.25*

(10 marks/*markah*)

5. Owing to extensive occurrences of **soil erosion** failures especially during long term and heavy rainstorms at mineral development and industrial sites; evaluate the importance of:

*Oleh sebab sering berlakunya kegagalan kesan **hakisan tanah** terutama pada musim hujan lebat ditapak pembangunan mineral dan tapak industri; nilaikan kepentingannya:*

[a] the **mechanics** of soil erosion failures and the major **classification** of soil erosion failures,

***mekanik** berlakunya kegagalan hakisan tanah dan **pengelasan** utama jenis kegagalan hakisan tanah,*

(5 marks/*markah*)

[b] variables to be taken into account in assessing the **rate of soil erosion** for the site,

*ciri-ciri pembolehubah dalam penaksiran **kadar kegagalan hakisan tanah** untuk sesuatu tapak,*

(5 marks/*markah*)

[c] types of **soil erosion and sediment control measures** and their merits as best engineering management practices in the industry.

*jenis **kaedah pengawalan hakisan tanah dan kadar endapan** dan kelebihannya dalam amalan pengurusan kejuruteraan yang cekap.*

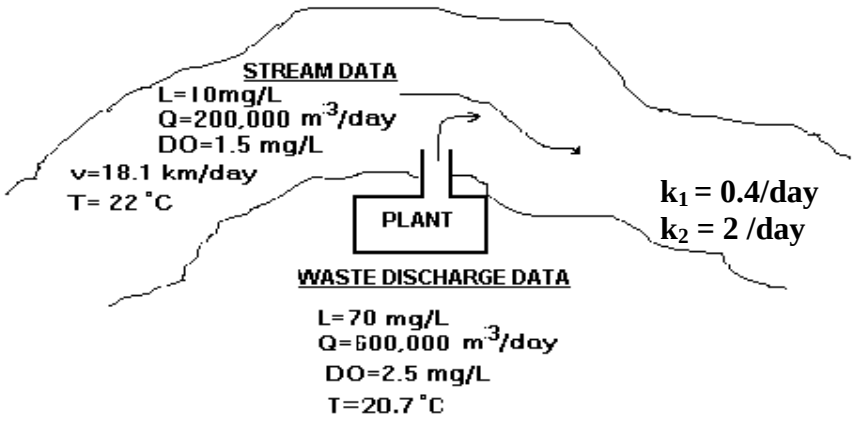
(10 marks/*markah*)

6. [a] Describe the importance in the determination of **'Dissolved Oxygen (DO)'** and **'Biochemical Oxygen Demand (BOD)'** values? Describe the methodology for the determination of the BOD values at respective study sites of water flows.

Apakah pandangan anda tentang kepentingannya penentuan nilai ***'Oksigen Terlarut' (DO)*** *dan* ***'Kegunaan Oksigen Biokimia' (BOD)*** *untuk pengawalan kualiti air. Terangkan kaedah untuk penentuan nilai BOD untuk sistem aliran sungai yang dikaji.*

(5 marks/*markah*)

[b] Determine the **Critical Oxygen Concentration (Do_{crit})** value in a stream due to the discharge from your industrial plant. The data collected are as follows:



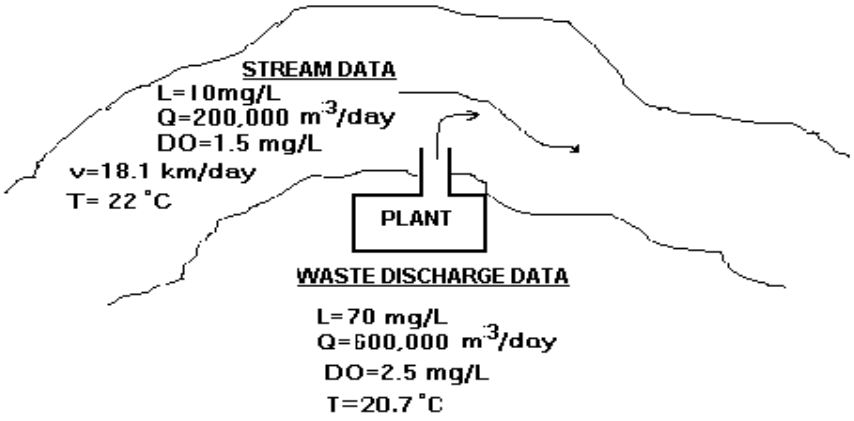
L : BOD value Q: Quantity of flow DO: Dissolved oxygen T: Temp.
k_1 : Deoxygenation constant k_2 : Reoxygenation constant

DO_{SAT} Tables

Temp, °C	DO, mg/L	Temp, °C	DO, mg/L
17	9.7	20	9.1
18	9.5	21	8.9
19	9.3	22	8.7

…10/-

Tentukan ***nilai oksigen terlarut kritikal (DO$_{krit}$)*** *kerana buangan air sisa daripada logi industri anda. Data yang dikumpulkan adalah seperti yang berikut:*



L : Nilai BOD Q: Kuantiti aliran DO: Oksigen terlarut T: Suhu k_1 : Malar penyahoksigenan k_2 : Malar oksigenan semula

Jadual DO$_{SAT}$

Suhu ^oC	*Oksigen terlarut mg/L*	*Suhu* ^oC	*Oksigen terlarut mg/L*
17	9.7	20	9.1
18	9.5	21	8.9
19	9.3	22	8.7

If the DO_{crit} for lifeform to exist in the stream is 4mg/L, in your opinion is the waste discharge from your industrial plant hazardous to the environment?

Jika nilai DO_{crit} untuk pengwujudan ikan dalam sungai ialah 4 mg/L, dalam pandangan anda adakah buangan sisa daripada logi industri anda merbahaya kepada alam sekitar?

(15 marks/*markah*)

7. [a] Assess the importance of **Sustainable Development** in the context of effective industrial development. Compare the importance, methodology and differences between **Environmental Impact Assessment (EIA)** as compared to **Environmental Audits** for systematic sustainable development in the industry.

Nilaikan kepentingan proses ***Pembangunan Lestari*** *dalam konteks pembangunan negara yang cekap. Bandingkan kepentingan, kaedah dan perbezaan di antara* ***Penilaian Kesan Alam Sekitar (EIA)*** *dan* ***Audit Alam Sekitar*** *untuk pembangunan lestari yang sistematik dalam industri.*

(15 marks/*markah*)

[b] Discuss the environmental factors that have to be considered in an **Environmental Impact Assessment** study in the development and planning of either an industrial plant, quarry or petroleum development site.

Bincangkan faktor-faktor alam sekitar yang perlu dipertimbangkan dalam projek ***Penilaian Kesan Alam Sekitar*** *untuk pembangunan dan perancangan salah satu tapak logi industri, kuari. atau tapak pembangunan minyak.*

(5 marks/*markah*)

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