

**SULIT**

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First Semester Examination  
2017/2018 Academic Session

January 2018

**EAP415 – Solid Waste Management  
(Pengurusan Sisa Pepejal)**

Duration : 2 hours  
(Masa : 2 jam)

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Please check that this examination paper consists of FOUR (4) pages of printed material before you begin the examination.

*[Sila pastikan bahawa kertas peperiksaan ini mengandungi EMPAT (4) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

**Instructions** : Answer **FOUR (4)** questions in this examination paper.

**Arahan** : Jawab **EMPAT (4)** soalan di dalam kertas peperiksaan ini.]

In the event of any discrepancies, the English version shall be used.

*[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunakan.]*

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1. (a) Solid waste generation rate is affected by several factors. With a suitable example each, explain **FIVE (5)** factors that influence the solid waste generation rate.

*Kadar penjanaan sisa pepejal dipengaruhi oleh beberapa faktor. Dengan setiap contoh yang sesuai, terangkan **LIMA (5)** faktor yang mempengaruhi kadar penjanaan sisa pepejal.*

[10 marks/markah]

- (b) Queens Bay Mall has 300 commercial shoplots. If the average daily solid waste generation rate is 150 kg per shop and the waste collection is scheduled 3 times per week, calculate the number of storage container required to be supplied. (Standard waste container size is 2.5 m<sup>3</sup> with utility rate is 0.8. Assume waste density is 130 kg/m<sup>3</sup>)

*Queens Bay Mall mempunyai 300 lot kedai komersial. Sekiranya kadar harian penjanaan sisa pepejal setiap kedai adalah 150 kg dan kutipan sisa dijadualkan 3 kali seminggu, kirakan jumlah tong sampah yang perlu dibekalkan. (Saiz standard tong sampah adalah 2.5 m<sup>3</sup> dengan tahap penggunaan 0.8. Aggarkan ketumpatan adalah 130 kg/m<sup>3</sup>)*

[15 marks/markah]

2. (a) Describe **FIVE (5)** criteria of a sanitary landfill.

*Terangkan **LIMA (5)** kriteria tapak kambus tanah sanitari.*

[10 marks/markah]

- (b) Bertam New Township with 25000 population generated solid waste at a rate of 1.2 kg/capita-day. A new 10 hectares landfill will be constructed at a maximum of 15 meters height. If the waste can be compacted up to 650 kg/m<sup>3</sup> and the ratios of solid waste to soil cover is 15%, calculate the volume of soil cover needed in a year and the landfill lifespan.

*Bandar Baharu Bertam dengan populasi 25000 telah menjanakan sisa pepejal pada kadar 1.2 kg/kapita/hari. Sebuah tapak pelupusan seluas 10 hektar akan dibina dengan ketinggian maksima sehingga 15 meter. Jika sisa pepejal boleh dimampatkan sehingga 650 kg/m<sup>3</sup> dan nisbah sisa pepejal dan tanah penutup sebanyak 15%, kirakan isipadu tanah penutup diperlukan setahun dan jangka hayat tapak pelupusan tersebut.*

[15 marks/markah]

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3. (a) There are at least eight different forms of composting systems for processing a wide range of organic materials. Sketch the rotating drum, turned windrow and passively aerated windrow system and compare between these **THREE (3)** composting systems.

*Terdapat sekurang-kurangnya lapan jenis sistem pengkomposan untuk memproses pelbagai bahan organik. Lakar dram yang berputar, tebas susun berbalik dan sistem tebas susun berudara pasif dan bandingkan antara **TIGA (3)** sistem kompos tersebut.*

[12 marks/markah]

- (b) Anaerobic digestion of solid wastes involves the reduction of organic matter and the generation of methane gas. Sketch and describe the **FOUR (4)** phases of anaerobic digestion process.

*Pencernaan anaerobik terhadap sisa pepejal melibatkan pengurangan bahan organik dan penjanaan gas metana. Lakar dan terangkan **EMPAT (4)** fasa proses pencernaan anaerobik.*

[13 marks/markah]

4. A 10 years old landfill in Penang is currently in upgrading process in keeping with legislation as well as health practice and cost effective operation. As an environmental engineer, you have been asked to :

*Satu tapak pelupusan berusia 10 tahun di Pulau Pinang kini sedang dalam proses peningkatan selaras dengan undang-undang serta praktis amalan kesihatan dan kos operasi yang efektif. Sebagai jurutera alam sekitar, anda telah diminta untuk:*

- (a) Describe **FIVE (5)** factors that affect the landfill gas generation.

*Jelaskan **LIMA (5)** faktor yang mempengaruhi penjanaan gas tapak pelupusan.*

[10 marks/markah]

- (b) Suggest a cost effective pre-chemical leachate treatment together with the process sketch.

*Cadangkan olahan larut lesapan pra-kimia yang berkos efektif bersama lakaran proses.*

[7 marks/markah]

- (c) Suggest a cost effective biological treatment for simultaneous nitrogen and phosphorus removal, and together with the process sketch.

*Cadangkan olahan biologi yang berkos efektif untuk penyingkiran nitrogen dan fosforus secara serentak , dan bersama-sama dengan lakaran proses itu.*

[8 marks/markah]

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