

**CONFIDENTIAL**



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2013/2014**

COURSE NAME : ENVIRONMENTAL ENGINEERING  
COURSE CODE : BFC 32403/ BFC 3103  
PROGRAMME : 3 BFF  
EXAMINATION DATE : JUN 2014  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER FIVE (5) QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF ELEVEN (11) PAGES

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**ENGLISH**

- Q1** (a) List **FOUR (4)** effects of overpopulation to environment. (4 marks)
- (b) The National Policy on the environment is based on 8 principles. Explain **FOUR (4)** principles. (8 marks)
- (c) Regulation and National Policy for environment are developed to enhance the quality of life of the people through sustainable development. Discuss the difference between regulation and policy and their interrelationship. (8 marks)
- Q2** (a) Define pH and calculate hydrogen ion concentration  $[H^+]$  in mg/L for a rainwater sample with pH 5.6. (3 marks)
- (b) Briefly discuss the effects of excess nutrients to the environment in particular of surface water body. (5 marks)
- (c) (i) Define ultimate BOD,  $L_0$ . (1 mark)
- (ii) The BOD of wastewater sample is estimated to be 250 mg/L. What is the volume of undiluted wastewater sample should be added to a 300 mL bottle? Assume that 5 mg/L BOD can be consumed in the BOD bottle. (2 marks)
- (iii) The BOD of a municipal wastewater at the end of day 7 is 120 mg/L and the ultimate BOD is 250 mg/L. Determine the reaction rate constant (base  $e$ ),  $k$  if the temperature is 20°C. (3 marks)
- (d) Two streams converge as shown in the sketch Q2 (d) (Appendix). Determine the flow, DO,  $BOD_5$  and BOD ultimate in the merged streams at point C. (Given BOD rate constant,  $k = 0.26/\text{day}$ ). (6 marks)

- Q3** (a) Define the following water treatment processes:
- (i) Softening
  - (ii) Coagulation/flocculation
  - (iii) Sedimentation
  - (iv) Disinfection
- (4 marks)
- (b) With aid of diagram, explain coagulation and flocculation process.
- (6 marks)
- (c) Calculate the diameter and depth of a circular clarifier for a design flow of  $3500 \text{ m}^3/\text{d}$ , an overflow rate of  $0.0002 \text{ m/s}$  and a detention time of 3 h. Calculate also the weir loading rate by assuming the total effluent weir is 20 m.
- (10 marks)
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- Q4** (a) In the biological treatment of wastewater, define the following terms associated with the micro-organisms;
- (i) Biomass
  - (ii) Lag phase
  - (iii) Log-growth phase
  - (iv) Stationary phase
  - (v) Endogenous phase
  - (vi) Suspended/Dispersed growth
  - (vii) Fixed/Attached growth
- (7 marks)
- (b) Flow equalization is an important option in a wastewater treatment plant. Explain the importance of flow equalization to the overall operation of the plant.
- (3 marks)
- (c) A primary settling tank is to handle maximum hourly wastewater flow of  $0.6 \text{ m}^3/\text{s}$  at an overflow rate of  $62 \text{ m/day}$ . Determine the surface area of the tank and calculate the hydraulic detention time if the tank depth is 3.2 m.
- (4 marks)
- (d) A completely mixed activated-sludge plant is to treat  $10,000 \text{ m}^3/\text{day}$  of industrial wastewater. The wastewater has BOD of  $1000 \text{ mg/L}$  that must be reduced to  $150 \text{ mg/L}$  prior to discharge to a municipal sewer. Analysis from the plant indicates mean-cell residence time (MCRT) is 5 days while maintaining MLSS concentration of  $5000 \text{ mg/L}$  produces the desired

results. Determine the volume of the reactor if value of  $Y$  is 0.7 kg/kg and  $k_d$  is 0.03/day.

(6 marks)

**Q5** (a) List sources of solid waste generation and types of solid waste. (5 marks)

(b) Explain factors that may influence the rate of solid waste generation. (5 marks)

(c) From the following data, estimate the unit waste generation rate in kg/capita/day for a residential area consisting 1500 houses. The observation period was one week. Assume that each household is comprised of 4.5 people.

Number of compactor truck loads	=	20
Volume of compactor truck	=	15 m <sup>3</sup>
Density of solid waste compacted in compactor truck	=	297 kg/m <sup>3</sup>
Number of flatbed truck	=	15
Volume of flatbed truck	=	5 m <sup>3</sup>
Density of solid waste in flatbed truck	=	89 kg/m <sup>3</sup>

(10 marks)

**Q6** (a) Differentiate the primary and secondary air pollutant by giving at least **ONE (1)** source for each pollutant. (4 marks)

(b) In a construction site, it is found that the particulate matter is less than 10  $\mu\text{m}$ . What are the major concerns of health impact to surrounding people and environment? (6 marks)

(c) City A council received two reports from the residents which are deterioration of their house structure and damage of the leaf tissue.

(i) What are the possible phenomena of this problem? Give **TWO (2)** sources and mechanism of air pollutants that responsible for this occurrence.

- (ii) Propose possible treatment for industries to control the air pollution problem in City A.

(10 marks)

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**-END OF QUESTION-**

**BAHASA MELAYU**

- S1 (a) Senaraikan **EMPAT (4)** kesan lebih penduduk kepada alam sekitar. (4 markah)
- (b) Dasar Negara terhadap alam sekitar adalah berasaskan kepada 8 prinsip. Terangkan **EMPAT (4)** prinsip. (8 markah)
- (c) Peraturan dan Dasar alam sekitar yang dibangunkan untuk meningkatkan kualiti hidup rakyat melalui pembangunan lestari. Bincangkan perbezaan di antara peraturan dan dasar dan hubungkait antara mereka. (8 markah)
- S2 (a) Berikan definisi pH dan kira kepekatan ion hidrogen  $[H^+]$  di dalam unit mg/L bagi suatu sample air hujan yang mempunyai pH 5.6. (3 markah)
- (b) Bincangkan dengan ringkas kesan lebih nutrient terhadap persekitaran terutamanya kepada jasad air permukaan. (5 markah)
- (c) (i) Berikan definisi BOD muktamad,  $L_0$ . (1 markah)
- (ii) Permintaan oksigen biokimia (BOD) bagi suatu sampel air sisa yang tidak dicairkan adalah dianggarkan sebanyak 250 mg/L. Berapakah isipadu sampel air sisa yang perlu dimasukkan ke dalam botol BOD yang berisipadu 300 mL? Anggap sebanyak 5 mg/L BOD akan terguna di dalam botol BOD. (2 markah)
- (iii) Permintaan oksigen biokimia (BOD) bagi suatu sampel air sisa perbandaran selepas hari ke 7 adalah sebanyak 120 mg/L dan BOD muktamad adalah sebanyak 250 mg/L. Tentukan pemalar kadar tindakbalas (asas  $e$ ),  $k$  sekiranya suhu adalah 20°C. (3 markah)
- (d) Berikut ialah lakaran sistem aliran dua sungai seperti di lampiran Q2 (d). Kira kadar alir,  $BOD_5$ , BOD muktamad dan oksigen terlarut (DO) pada titik percampuran C. (Diberi pemalar kadar BOD,  $k = 0.26/\text{hari}$ ) (6 markah)

- S3** (a) Definiskan proses-proses rawatan air berikut:
- (i) Pelembutan
  - (ii) Koagulasi/Flokulasi
  - (iii) Pemendapan
  - (iv) Penyahkuman
- (4 markah)
- (b) Dengan berbantuan gambarajah, jelaskan proses koagulasi dan flokulasi.
- (6 markah)
- (c) Kira diameter dan kedalaman tangki penjernih bulat dengan kadar alir  $4000 \text{ m}^3/\text{hari}$  dan kadar limpah  $0.0002 \text{ m/s}$  berserta masa tahanan selama 3 jam. Dapatkan kadar aliran sempak dengan menganggap jumlah efluen sempak ialah 20 m.
- (10 markah)
- 
- S4** (a) Dalam satu proses rawatan air sisa secara biologi, terangkan setiap istilah berikut yang berkaitan dengan organisma-mikro;
- (i) Biomass
  - (ii) Fasa lag
  - (iii) Fasa pertumbuhan log
  - (iv) Fasa pegun
  - (v) Fasa *endogenous*
  - (vi) Pertumbuhan terampai/berselerak
  - (vii) Pertumbuhan tetap/lekat
- (7 markah)
- (b) Penyamaan kadar alir adalah sangat penting dalam operasi sebuah loji rawatan air sisa. Terangkan kepentingan penyamaan kadar alir tersebut kepada keseluruhan operasi loji rawatan.
- (3 markah)
- (c) Satu tangki pemendapan primer dikehendaki menerima kadar alir maksimum  $0.6 \text{ m}^3/\text{s}$  dengan kadar limpahan  $62 \text{ m}/\text{hari}$ . Kirakan luas permukaan tangki dan masa tahanan hidraulik jika kedalaman tangki ialah 3.2 m.
- (4 markah)
- (d) Satu loji enapcemar teraktif pencampuran penuh dibina untuk mengolah  $10,000 \text{ m}^3/\text{hari}$  air sisa industri. Air sisa tersebut mengandungi  $1000 \text{ mg/L}$  BOD yang mesti dirawat sehingga nilainya mencapai  $150 \text{ mg/l}$  sebelum disalurkan ke sistem saluran kumbahan bandaran. Analisis dari loji rawatan

nilai kepekatan MLSS bersamaan 5000 mg/L menghasilkan keputusan yang dikehendaki. Tentukan isipadu reaktor jika nilai  $Y$  ialah 0.7 kg/kg dan  $k_d$  ialah 0.03/hari.

(6 markah)

- S5** (a) Nyatakan punca-punca yang lazim menjana sisa pejal berserta jenis-jenis sisa pejal yang dijanakan. (5 markah)
- (b) Huraikan faktor-faktor yang boleh mempengaruhi kadar penjanaan sisa pejal. (5 markah)
- (c) Daripada maklumat yang diberi, dapatkan anggaran unit kadar penjanaan sisa pejal dalam kg/kapita/hari bagi satu kawasan perumahan mempunyai 1500 buah rumah. Pemerhatian adalah selama dua minggu. Anggap seisi rumah mengandungi 4.5 orang.

Jumlah pungutan oleh trak pemampat	= 20
Isipada trak pemampat	= 15 m <sup>3</sup>
Ketumpatan sisa bagi trak pemampat	= 297 kg/m <sup>3</sup>
Jumlah pungutan oleh trak biasa	= 15
Isipadu trak biasa	= 5 m <sup>3</sup>
Ketumpatan sisa bagi trak biasa	= 89 kg/m <sup>3</sup>

(10 markah)

- S6** (a) Bezakan pencemar udara rendah dan menengah dengan memberi sekurang-kurangnya **SATU (1)** sumber setiap pencemar. (4 markah)
- (b) Di tapak pembinaan, didapati bahawa partikel zarah adalah kurang daripada 10  $\mu\text{m}$ . Apakah kesan utama terhadap kesihatan kepada orang-orang di sekeliling dan alam sekitar? (6 markah)
- (c) Majlis Bandaraya A menerima dua laporan daripada penduduk mengenai kemerosotan struktur rumah mereka dan kerosakan tisu daun.
- (i) Apakah fenomena yang mungkin bagi masalah ini? Berikan **DUA**



- (2) sumber dan mekanisma bahan pencemar udara yang bertanggungjawab untuk kejadian tersebut.
- (ii) Cadangkan rawatan mungkin untuk industri untuk mengawal masalah pencemaran udara di Bandaraya A.
- (10 markah)

**-SOALAN TAMAT-**

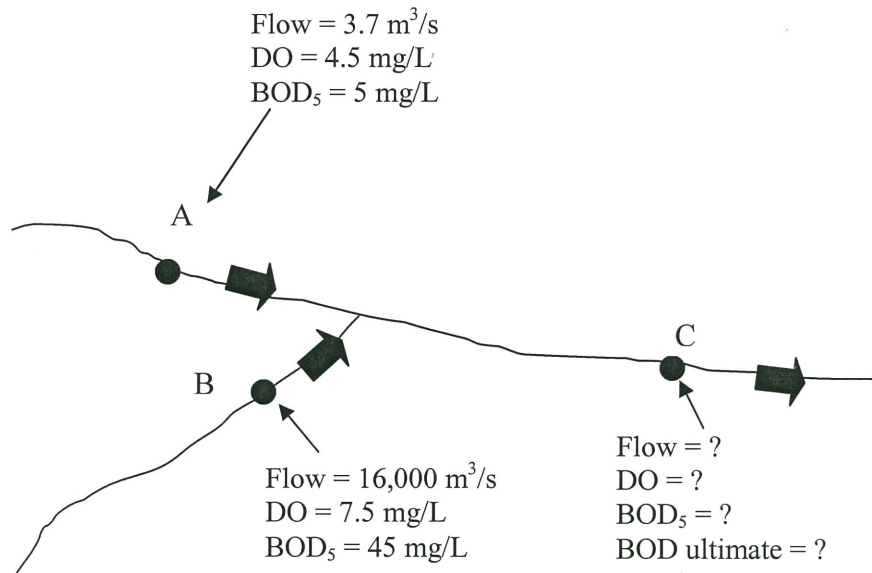
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**Q 2 (d)**



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Formula Given:

$$(1) \quad DO = \frac{Q_w DO_w + Q_r DO_r}{Q_w + Q_r}$$

$$(2) \quad La = \frac{Q_w L_w + Q_r L_r}{Q_w + Q_r}$$

$$(3) \quad T_f = \frac{Q_w T_w + Q_r T_r}{Q_w + Q_r}$$

$$(4) \quad k_T = k_{20} (\theta)^{T-20}$$

$$(5) \quad S = \frac{K_s (+k_d \theta_c)}{\theta_c (\mu_m - k_d) - 1}$$

$$(6) \quad X = \frac{\theta_c (Y)(S_0 - S)}{t_c (1 + k_d \theta_c)}$$

$$(7) \quad \theta = V / Q_0$$

$$(8) \quad \Phi_c = VX / Q_0 X_w$$