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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019**

COURSE NAME : ENVIRONMENTAL RISK
ASSESSMENT
COURSE CODE : BNA 30903
PROGRAMME CODE : BNA
EXAMINATION DATE : JUNE/JULY 2019
DURATION : 2 HOURS 30 MINUTES
INSTRUCTIONS : ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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- Q1** (a) List **THREE (3)** risk assessment process model. (3 marks)
- (b) Identify **THREE (3)** methods that can be used in hazard identification process. (6 marks)
- (c) Discuss the risk assessment process involved of air pollution occurred at Sungai Kim-Kim, Pasir Gudang Johor. (10 marks)
- (d) Demonstrate the HAZOP process as one of the methods used in hazard identification process. (6 marks)
- Q2** (a) Define the acute, sub-chronic and chronic exposures. (6 marks)
- (b) Describe the following terms: (9 marks)
- (i) Exposure routes.
 - (ii) Receptors.
 - (iii) Exposure assessment.
- (c) Raja drinks water from a contaminated well for 30 years. The resulting dose rate changes because the concentration of the contaminant in the well decreases with time. If the dose rate is given by $\dot{D}(t) = 0.05 \exp(-t/7000d), \text{mg}(c)/\text{kg}\cdot\text{d}$, where t has unit of days, calculate the following:
- (i) The total dose.
 - (ii) The dose rate averaged over the exposure period (i.e. average daily dose).

- (iii) The dose averaged over an averaging time of 70 years (i.e. lifetime average daily dose).

(10 marks)

- Q3** (a) Analyze the difference between Quantal and Graded dose-response curves.

(6 marks)

- (b) A 50 years old man with a heart problem is to be treated with a diuretic drug. Drugs X and Y have the same mechanism of diuretic action. Drug X in a dose of 10mg produces the same magnitude of diuresis as 1000mg of drug Y.

- (i) State which drug is less efficacious.
(ii) State which drug is more potent.
(iii) State which drug has a lower toxicity.
(iv) State which drug is safer.
(v) State which drug will have a longer duration of action.

(10 marks)

- (c) Briefly describe the term Therapeutic Index (TI).

(3 marks)

- (d) Define the following terms:

- (i) LD_{50}
(ii) ED_{50}
(iii) TD_{50}

(6 marks)

- Q4** (a) Define the meaning of Risk Characterization on dose response.

(3 marks)

- (b) Based on experiments with mice, a human threshold dose for chronic ingestion exposure to an organic solvent is estimated to be 42mg/(kg d). An assessment of exposure to contaminated groundwater indicates that a reasonable maximum

exposure level to the solvent in contaminated groundwater was 0.894mg/(kg.d). Calculate the daily margin of safety at this level of exposure.

(4 marks)

- (c) A population is exposed to polychlorinated biphenyls at a dose of 7×10^{-5} mg/(kg.d) and dieldrin at a dose of 4×10^{-6} mg/(kg/d). Assume that the cancer slope factor for the PCB is $4.34(\text{mg}/(\text{kg.d}))^{-1}$ and dieldrin is $30 (\text{mg}/\text{kg.d})^{-1}$.

- (i) Calculate the combined risk of these two contaminants (Assumption: cancer risk from this two mixture is additive).

(4 marks)

- (ii) If 10,000 people are exposed at this level, calculate the upper bound on the number of contaminant-induced cancers.

(2 marks)

- (d) Identify the exposure duration as stated by the Environmental Protection Agency in 2002.

(6 marks)

- (e) Demonstrate **THREE (3)** factors affecting risk.

(6 marks)

- END OF QUESTIONS-

FINAL EXAMINATION

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LIST OF FORMULAS

$$D_T = \int_0^{t_e} \dot{D}(t) dt$$

$$\bar{D} = \frac{\int_0^{t_e} \dot{D}(t) dt}{t_{avg}} = \frac{D_t}{t_{avg}}$$

$$\int e^{-x} dx = -e^{-x}$$

$$\int e^{ax} dx = \frac{1}{a} e^{ax}$$

$$R \approx \rho D$$

$$R \approx \rho E$$

$$I = RP$$

$$I = \rho DP$$

$$I = \rho EP$$