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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016**

COURSE NAME : PROCESS SAFETY ENGINEERING
COURSE CODE : BNL 40403
PROGRAMME : 4 BNL
EXAMINATION DATE : DECEMBER 2015/JANUARY 2016
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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- Q1**
- (a) With the sketch drawing, identify the main routes by which hazardous substances can enter the body. (5 marks)
- (b) With the graph (Blood level vs Time after administration) discuss the factors which influence the absorption, distribution, storage and excretion of hazardous substances (6 marks)
- (c) Discuss the method to control of entry routes of toxicants. (4 marks)
- (d) Critically discuss the main features of dose response curves. (5 marks)
- Q2**
- (a) As a plant technologist, the chemical usage and the term understanding is very important. Describe the term below:
- (i) Airborne concentration
 - (ii) Ceiling limit
 - (iii) Chemical hazardous to health
 - (iv) Chemical safety data sheet
 - (v) Maximum exposure limit
 - (vi) Permissible exposure limit
 - (vii) Time weighted average
 - (viii) Labeling
 - (ix) Relabeling
 - (x) Warning sign
- (5 marks)
- (b) List **FIVE (5)** chemical substance that are related to biodiesel process and the information must include the CAS Number, PEL (TWA airborne concentration) (5 marks)
- (c) Based on Methanol MSDS, describe the following item:
- (i) Emergency Overview
 - (ii) Potential health hazard
 - (iii) Handling and Storage
 - (iv) Accidental release measure
 - (v) Disposal
- (10 marks)

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- Q3** (a) Air sample for a worker's exposure to oil mist were found to indicate the following levels.

Sample	Measured Amount	Time of Sample
Sample 1	3 mg/m ³	2 hours
Sample 2	28 mg/m ³	4 hours
Sample 3	14 mg/m ³	2 hours

- (i) Calculate the TWA (3 marks)
- (ii) If the sample name is Chemical substance (Sodium Hydroxide), what are the PEL and give your comment on result in (i). (4 marks)
- (b) A process involves the use of two solvents that act synergistically on the body. Air sampling indicates that the individual PELs for each solvent are not exceeded.

The following information is obtained by the industrial hygienist :

Solvent	USECHH Regulations 2000	Eight-hour Measured Exposure
Ethyl acetate	400 ppm	250 ppm
Benzyl chloride	1 ppm	0.75 ppm

- (i). Calculate the PEL (3 marks)
- (ii). However, does the exposure exceed the allowable level under the USECHH mixture rule? Decision making based on result in (i). (4 marks)
- (c) Determine the 8-hr TWA worker exposure if the worker is exposed to toluene vapors as follows :

Measured Amount	Time of Sample
110 ppm	2 hours
330 ppm	2 hours
90 ppm	4 hours

(6 marks)

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Q4 (a) Emergency and Response Plan (ERP) are the key element to protect the workers, properties and the environment. As a plant technologist, the concept of ERP must be clearly informed. Emergency management consists of organized programs and activities taken to deal with actual or potential emergencies or disasters. It is based on a risk management approach and includes the following five components. Briefly explain the components.

- (i) Prevention
- (ii) Mitigation
- (iii) Preparedness
- (iv) Response
- (v) Recovery

(10 marks)

(b) Personal protective equipment (PPE) is compulsory and top priority. Describe the requirement on PPE based on OSHA 1994 and if not fulfill the requirement, what are the penalti should be taken to the staff.

(3 marks)

(c) Based on **Figure Q4 (c)**, discuss the preparation on how biodiesel process can be done in safer environment.

(7 marks)

Q5 (a) Xylene is used as a solvent in paint. A certain painting operation evaporates an estimated 3 gal of xylene in an 8-hr shift. The ventilation quality is rated as average. Determine the quantity of dilution ventilation air required to maintain the xylene concentration below 100 ppm, the PEL-TWA. Also compute the air required if the operation is carried out in an enclosed hood with an opening of 50 ft² and a face velocity of 100 ft/min. The temperature is 77⁰F and the pressure is 1 atm. The specific gravity of the xylene is 0.864, and its molecular weight is 106.

(10 marks)

(b) The essential elements for combustion are fuel, an oxidizer and ignition source.

- (i) Sketch the fire triangle
- (ii) Identify the source of fuels, oxidizers and ignition source
- (iii) With sketch drawing, show the relationship between various flamability properties.

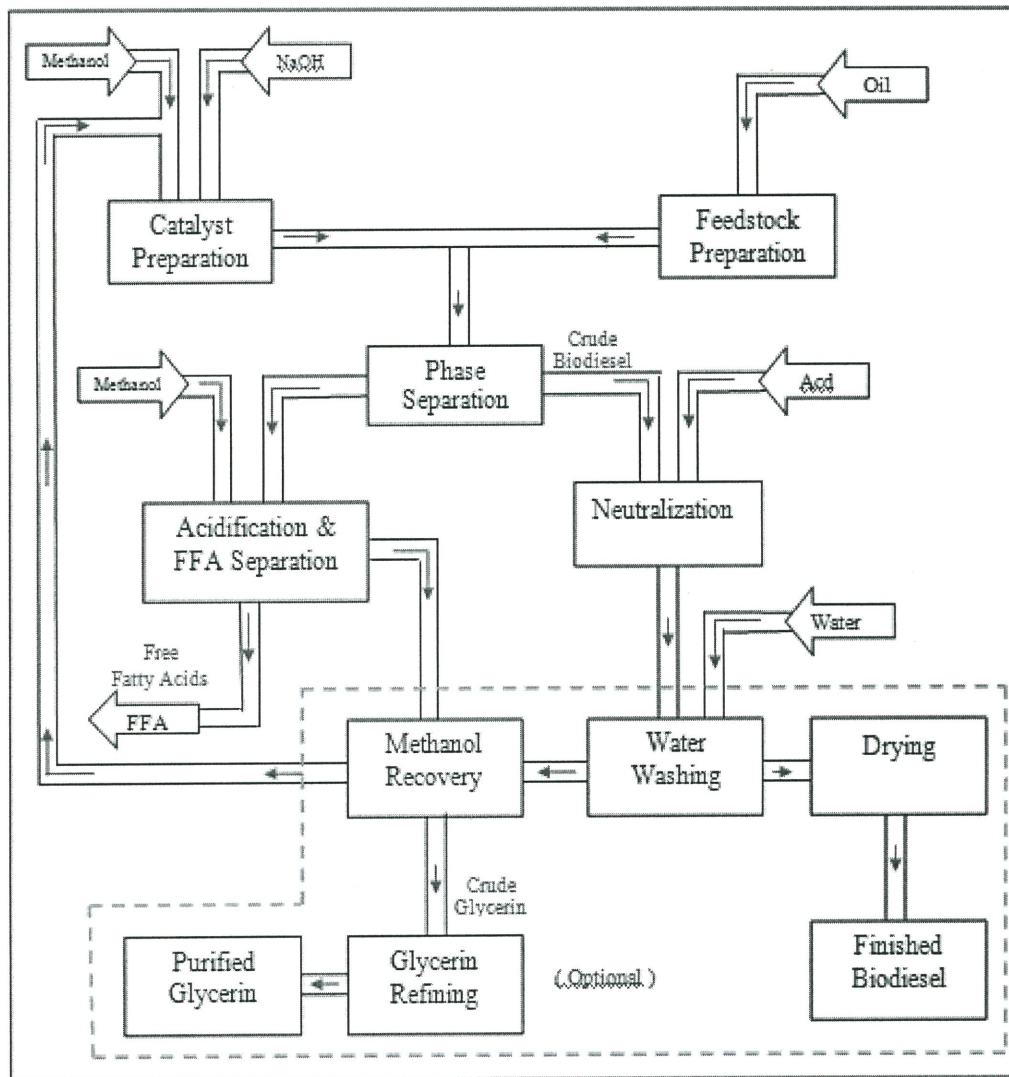
(10 marks)

- END OF QUESTION -**CONFIDENTIAL**

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Biodiesel Production Process

FIGURE Q4 (c)