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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : FUNDAMENTALS OF PLANT
ENGINEERING TECHNOLOGY
COURSE CODE : BNL 20102
PROGRAMME : 2 BNL
EXAMINATION DATE : DECEMBER 2013/JANUARY 2014
DURATION : 2 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

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Q1 A feed stream F consists of four different components A, B, C and D is fed to the separator for purification purpose, as shown in Figure **Q1**.

Data given are as follows:

$$F = 100 \text{ kg/min}$$

$$X_{CF} = 0.1$$

$$X_{DF} = 0.1$$

$$X_{AW} = 0.5$$

$$X_{BW} = 0.15$$

$$X_{DW} = 0.19$$

$$X_{AD} = 0.5$$

$$X_{BD} = 0.4$$

- (a) Apply the mass balance of the streams and the material balance of each component. (8 marks)
- (b) Determine the mass fraction X_{AF} and X_{BF} in the stream F (6 marks)
- (c) Calculate the remaining mass fraction X_{CW} and X_{CD} . (6 marks)
- (d) After one hour operation, what is the value of the product stream F_D and the byproduct F_W (5 marks)
- Q2** (a) By using sketches, show three common types of flows occur in a shell tube heat exchanger. (9 marks)
- (b) State three parameters to increase the heat transfer rate between two different media. (7 marks)
- (c) Match the valve type with its description in Table Q2. (9 marks)

Table Q2

| Valve Type | Description |
|------------|---|
| Ball | a. Designed to open if the pressure of a gas exceeds a preset threshold |
| Butterfly | b. Uses a disc-shaped flow control element to increase or decrease flow |
| Check | c. Uses a hollow-out plug to increase or decrease flow |
| Diaphragm | d. Use a rubber-type diaphragm to control flow |
| Gate | e. Uses a metal gate to block the flow of fluid |
| Globe | f. Uses a hollow-out ball to increase or decrease flow |
| Plug | g. Designed to open if the pressure of a liquid exceeds a preset level |
| Relief | h. Uses a spherical or globe-shaped plug to block fluid flow |
| Safety | i. Uses to prevent accidental backflow |

- Q3** (a) Describe the water circulation in a water tube boiler by using a sketch.
(10 marks)
- (b) State four common water treatment methods applied in a boiler.
(8 marks)
- (c) Differentiate between deaeration and reverse osmosis process used in a boiler feedwater.
(7 marks)

- Q4** An ideal binary mixture comprising the pure components A and B has the saturated temperatures and the associated pressures listed in Table Q4. The total pressure of the mixture is 101.32 kPa.

Table Q4

| $T [^{\circ}\text{C}]$ | A | B |
|------------------------|-------------------------------|-------------------------------|
| | $P_{\text{vap}} [\text{kPa}]$ | $P_{\text{vap}} [\text{kPa}]$ |
| 80.10 | 101.32 | |
| 85.00 | 116.90 | 46.00 |
| 90.00 | 135.50 | 54.00 |
| 100.00 | 179.20 | 74.30 |
| 105.00 | 204.20 | 86.00 |
| 110.60 | 240.00 | 101.32 |

- (a) Which component is more volatile compound. Reason your answer.

(3 marks)

- (b) Correlate the mole fraction of the component A in the liquid phase (x_A) and vapor phases (y_A) as a function of the pressures.

(7 marks)

(c) Determine the mole fractions x_A and y_A for each temperature.

(7 marks)

(d) Plot your answer in item (c) in a graph of T-xy. Use 15 °C for the interval in the vertical axe and 0.1 for the interval in xy axe.

(8 marks)

- END OF QUESTION -

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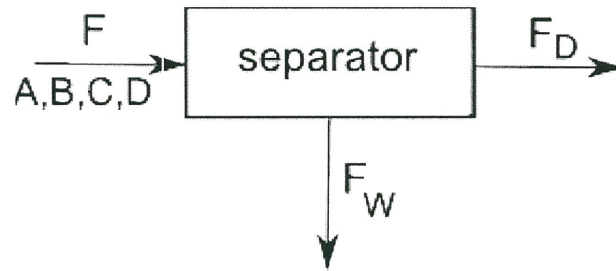


FIGURE Q1

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