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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : PLANT DESIGN AND PROCESS
COURSE CODE : DAK 23603
PROGRAMME : DAK
EXAMINATION DATE : DECEMBER 2018/ JANUARY 2019
DURATION : 3 HOURS
**INSTRUCTION : SECTION A: ANSWER ALL
QUESTIONS**
**SECTION B: ANSWER TWO (2)
QUESTIONS ONLY**

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THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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SECTION A

- Q1**
- (a) Piping and instrumentation diagram (P&ID) illustrates the piping processes and interactions with other installed equipment and instrumentation. Explain the critical elements that should be understood by the stakeholders in designing the industrial plant.
(4 marks)
- (b) The presence or absence of a line determines the location of the physical device. Distinguish all the **three (3)** different lines in discrete instrument.
(6 marks)
- (c) Compare the differences between Block Flow Diagram (BFD), Process Flow Diagram (PFD) and Piping and Instrumentation Diagram (P&ID).
(6 marks)
- (d) In terms of processing facilities, Piping and Instrumentation Diagram (P&ID) is one type of a graphic representation.
- (i) Explain briefly the information obtained from P&ID.
(4 marks)
- (ii) Outline the importance of P&ID.
(5 marks)
- Q2**
- (a) Define the term inflation.
(1 marks)
- (b) Distinguish between Net Present Value (NPV) with Internal Rate of Return (IRR).
(6 marks)
- (c) As the chief financial officer at petrochemical industry, you have been presented with the project earned revenue from the sales RM 1,711,000 with the usage of RM 1,328,358 of total expenses. Given the assumption of 30% income tax and 10 years life of project with starting RM 1,222,593 of total capital investment. Calculate the payback period of the project.
(18 marks)

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SECTION B

- Q3** (a) Define limiting and excess reactants terminology. (2 marks)
- (b) Explain **three (3)** types of chemical processes available in industry. (6 marks)
- (c) Ammonia is synthesized from hydrogen gas (H_2) and nitrogen gas (N_2) in the Haber-Bosch process. The design production rate is 400 ton/day of ammonia. The conversion of nitrogen in the reactor (here define as mol nitrogen reacted / mol nitrogen in) is assumed to be about 20%. Unreacted hydrogen and nitrogen is separated from the ammonia product and recirculated to the reactor.
- (i) Write the balance equation representing the reaction. (2 marks)
- (ii) Calculate the composition of the initial raw material in ton/day for this process. (15 marks)
- Q4** (a) List **four (4)** major components which affect the capital cost estimation. (4 marks)
- (b) Distinguish between direct and indirect cost of fixed capital investment item for a chemical process plant. (8 marks)
- (c) As a chemical engineer, explain the significance of cost analysis to construct a production plant design. (5 marks)
- (d) Illustrate the characteristic of capital cost accuracy curve vs estimation time and label each type of estimation. (8 marks)

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- Q5** (a) A business team has decided to produce pharmaceutical products to gain larger profit for their company. Hence, selection of a location will be done thoroughly in order to design a plant for the production.
- (i) Describe **two (2)** main utilities needed for this industry.
(4 marks)
 - (ii) Explain **four (4)** critical factors should be considered when selecting a location for the industry.
(4 marks)
- (b) In order to ensure the production in a plant can be run smoothly, there are several things should be done including the limited screening of process selection and production trial. These processes are crucial as to ensure that products can be achieved according to specifications.
- (i) State **four (4)** factors should be considered in process selection.
(4 marks)
 - (ii) Explain the flow cycle of process selection.
(6 marks)
- (c) Productions in a plant depend upon the functional team. Explain the responsibility for each stakeholder in production team.
(7 marks)

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- Q6** (a) Industrial process would not encounter any problems in the future if thorough equipment selections are made. Explain the criteria that are crucial in selecting the specific equipment. (5 marks)
- (b) Products will be stored in a specific condition after undergoing final processes. Compare the different ways of storage for solid and liquid products. (4 marks)
- (c) There are several types of reactors used in the industry. Distinguish the functions of the reactors. (8 marks)
- (d) Separation process can be carried out using several equipment. Based on the equipment listed below, explain its function and describe the major/minor separated component when selecting the equipment.
- (i) Sieve (2 marks)
 - (ii) Decanter (2 marks)
 - (iii) Wifley Shaker Table (2 marks)
 - (iv) Crystallizer (2 marks)

- END OF QUESTION -

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