



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : INDUSTRIAL ENGINEERING
COURSE CODE : BDA 40102
PROGRAMME : 4 BDD
EXAMINATION DATE : JUNE/JULY 2016
DURATION : 2 HOURS
INSTRUCTION : **SECTION A: PLEASE ANSWER ALL QUESTIONS**
SECTION B: PLEASE ANSWER THREE (3) QUESTIONS FROM FIVE (5) QUESTIONS PROVIDED IN THIS SECTION.

THIS PAPER CONSISTS OF NINE (9) PAGES

SECTION A

Instruction: Please answer all questions in this section.

- Q1**
- (a) Industrial Engineers are often required to solve large and complex real world problem. Explain briefly to accomplish this statement.
(2 marks)
 - (b) Explain the job scope of the Industrial Engineer in manufacturing and logistics industry
(4 marks)
 - (c) According to the International Ergonomics Association (IEA) defines ergonomics or human factors as the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. Discuss and evaluate the **FOUR (4)** benefits of ergonomics in the workstation/workplace.
(6 marks)
 - (d) As an Industrial Engineer at Company ABC, you are required to design the computer workstation for office employees that include the monitor, table, chair, foot rest, document holder, keyboard, mouse etc. Using appropriate sketches, evaluate the concepts for ergonomic computer workstation.
(8 marks)

SECTION B

Instruction: Please answer FOUR (4) questions from FIVE (5) questions provided in this section.

- Q2 (a) The tasks shown in the following precedence diagram (Figure 1) are to be assigned to workstations with the intent of minimizing idle time. Management has designed an output rate of 275 units per day. Assume 440 minutes are available per day.

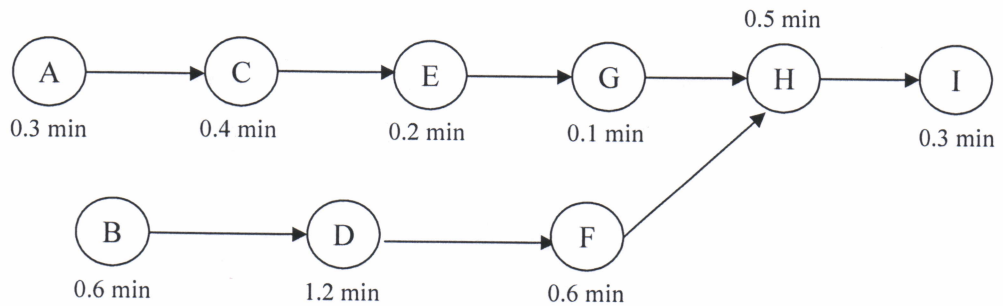


Figure 1: Precedence diagram

- (i) Determine the appropriate cycle time. (2 marks)
 - (ii) What is the minimum number of stations possible? (2 marks)
 - (iii) Assign tasks to stations based on the answer Q2(a)(ii). (2 marks)
 - (iv) Determine the theoretical maximum efficiency of the set up. (2 marks)
 - (v) Calculate the idle time for the line. (2 marks)
- (b) Universiti Tun Hussein Onn Malaysia will have another branch at Pagoh and will be operated in January 2017. The new campus will be equipped with various facilities for teaching & learning purposes. Therefore, there was a need to plan this campus development at the initial stage. If you were the engineer involved during the planning stage, discuss the needs of facilities planning based on facilities planning hierarchy as shown in Figure 2. (10 marks)

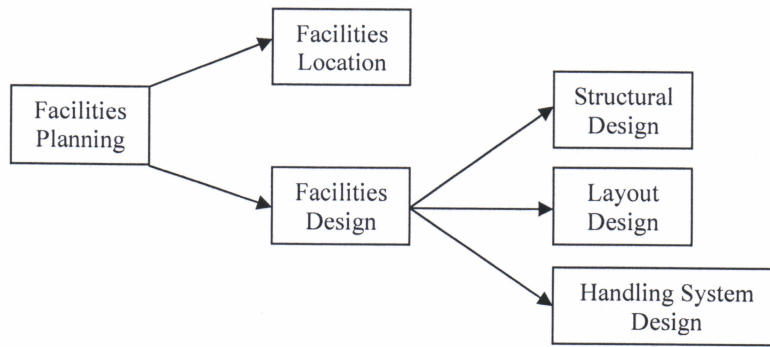


Figure 2: Facilities planning hierarchy

- Q3** (a) Describe the difference between Direct Time Study and Work Sampling Time Study. Give **ONE (1)** of its respective advantage and disadvantage. (5 marks)
- (b) Aji Marbo ice cream industry has assigned a senior supervisor to conduct work sampling study for 5 consecutive days. Numbers of observations and idles are summarized in **Table 1**. The industry operating in 5 days a week and 12 hours per day to cope for the predicted demand of 3000 boxes a week. The worker is rated at 110%. The allowances are 5% for fatigue, 6% for delay, and 6% for personal relief. The worker's salary is RM1000 per month (4 weeks).

Table 1: Work Sampling Data

Day	Numbers of Observations	Number of idle
Sunday	44	17
Monday	56	18
Tuesday	48	14
Wednesday	60	16
Thursday	52	15

- (i) Estimate the standard time for the ice cream production. (5 marks)
- (ii) If the predicted demand is 25,000 boxes per week, evaluate the requirement of production operators to cope for the demand. (5 marks)
- (iii) If the company can only manage to employ 4 workers, evaluate the requirement of overtime cost per week for the whole production line to cope for the demand. Assume all workers are available for over time and the overtime pay rate is 1.5 times of the normal wage. (5 marks)

- Q4** (a) The HC manufactures Jati-based wooden furniture. The production manager has planned a overtime schedule every weekend to reduce the backlog on the popular order furniture. **Table 2** shows the scheduling data which involves an ordering time, processing time, and due date for delivery.

Table 2: Ordering, Processing Time and Due Date Data

No. of Order	Estimated Processing Time (hours)	Due Date (Hours from now)
1	9	20
2	7	21
3	8	12
4	3	18
5	12	28
6	6	10

- (i) Analyze the schedules using First Come First Serve (FCFS), Early Due Date (EDD), and Shortest Processing Time (SPT) rules. (6 marks)
- (ii) Based on scheduling performance obtained in **Q4(a)(i)**, suggest your selection if Delivery Time is important. (4 marks)
- (b) GWL is a 500 room hotel in the North Woods. Managers need to keep close tabs on all room service items, including a special pine-scented bar soap. The daily demand for the soap is 275 bars. Ordering cost is RM30 and the inventory holding cost is RM 0.30 per bar per year. The lead time from supplier is 5 days. The lodge is open 365 days a year.
- (i) Estimate the Economic Order Quantity (EOQ) for the bar of soap. (5 marks)
- (ii) Based on EOQ obtained in **Q4(b)(i)**, suggest the requirement for Annual Inventory Cost. (5 marks)

- Q5** A newly developed organization insisted to introduce total quality management (TQM) in their company. However, they do not have any knowledgeable and experienced officer for TQM implementation. Therefore, they are hiring a consultant to assist them.

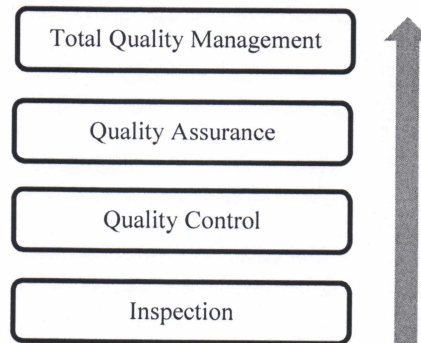


Figure 3: Quality hierarchy

As a consultant engineer, you need to conduct a basic training to explain about the quality hierarchy as shown in **Figure 3** which includes:

- (i) Differentiate between the levels of quality (8 marks)
- (ii) Why the management of the company insisted to implement TQM in their company? Defend the effects of TQM implementation. (8 marks)
- (iii) TQM consists of quantitative and qualitative tools and techniques. Determine at least **TWO (2)** tools and techniques for each category. (4 marks)

- Q6** (a) Distinguish between Push and Pull System in Just-In-Time (JIT). (4 marks)
- (b) The demand for subassembly product AAA is 150 units in week 7. Each unit of AAA requires 2 units of B and 1 unit of C. Each unit of B requires 3 units of D, 2 units of E, and 1 unit of F. Finally, each unit of C requires 3 units of E and 2 units of F. One firm manufactures all items. It takes 2 weeks to make AAA, 2 weeks to make B, 1 week to make C, 2 weeks to make D, 2 weeks to make E, and 1 week to make F.
- (i) Construct a product structure and identify all levels, parents, and components. (4 marks)
- (ii) Construct a net material requirements plan for item E and item F using the following on hand inventory and rules (**Table 3**). (12 marks)

Table 3: On-hand inventory for each item

Item	On-Hand Inventory	Rules	Item	On-Hand Inventory	Rules
AAA	50	L4L	E	30	FOQ=40
B	35	L4L	F	25	L4L
C	10	FOQ = 30			
D	20	FOQ = 50			

- END OF QUESTIONS -

FINAL EXAMINATION

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EQUATIONS

$$f(x, y) = \sum_{i=1}^n w_i (|x - a_i| + |y - b_i|)$$

Average completion time = sum of total flow time / Number of jobs

Utilization = Total jobs processing time / sum of total flow time

Average number of jobs in the system = Sum of flow time/ Total processing time

$$UCL_R = D_4 \bar{R}$$

$$LCL_R = D_3 \bar{R}$$

$$CL_x = \bar{x} \pm A_2 \bar{R}$$

$$\bar{X} = \frac{\sum \bar{X}}{g}$$

$$StdTime = \frac{TotalNormalTime}{1 - Allowance}$$

$$\bar{R} = \frac{\sum R}{g}$$

NormalTime = Average cycle Time × Rating

Standard Time, ST

$$= \frac{Total\ observation\ time}{Total\ output} \times Productive\ \% \times Rating \times \frac{1}{1 - allowance}$$

$$TM = \frac{\sum t}{c} Idle\ time = nc - \sum t Efficiency = \frac{\sum t}{nc} (100)$$